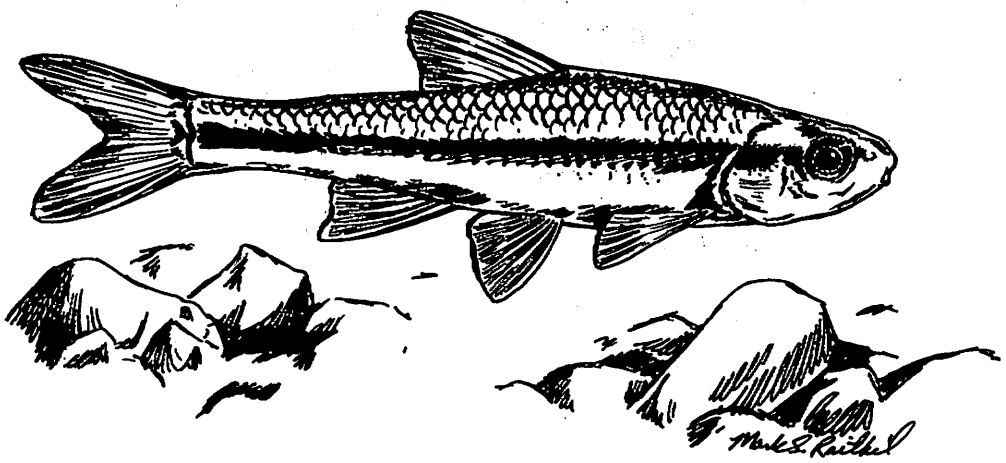
A Ten Year Strategic Plan for the Recovery of the Topeka Shiner in Missouri

July 1, 2010 – June 30, 2020



Missouri Department of Conservation
May 2010

A TEN YEAR STRATEGIC PLAN FOR

THE RECOVERY OF THE TOPEKA SHINER (*Notropis topeka*)

IN MISSOURI

CBV

Approved/Date: _____ 9/2/2010

Missouri Department of Conservation -- Director

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EXECUTIVE SUMMARY

Historically, Topeka shiners inhabited much of the western Tallgrass Prairie Region of the Midwest. In addition to Missouri, the Topeka shiner has been documented from Iowa, Kansas, Minnesota, Nebraska, and South Dakota. This species occurred in the headwater streams in much of the central and north parts of Missouri. The Topeka shiner was a formerly common and widespread species, but has become limited to several isolated populations in the state. The plight of the Topeka shiner is not restricted to this single species, but is indicative of the overall loss of high quality prairie stream habitat in Missouri and much of the Midwest.

The Missouri Department of Conservation (MDC) listed the Topeka shiner as a state endangered species in 1996. The United States Fish and Wildlife Service (USFWS) listed the Topeka shiner as a federally endangered species in 1998. At the present time, two Topeka shiner populations are known to exist in Missouri with a few other scattered occurrences of one or a few individuals reported.

Due to the plight of this species, the Missouri Topeka Shiner State Working Group was formed in late 1995. A document was drafted to guide MDC in initiating recovery activities; *An Action Plan for the Topeka Shiner (Notropis topeka) in Missouri* received MDC Director approval in January 1999. Since its approval, considerable progress has been made toward achieving the goals of this plan, including development of artificial propagation methodology, heightened awareness of degradation of prairie streams and Topeka shiner's plight through outreach and education efforts, development of Best Management Practices (BMP) for Topeka shiner watersheds, increased interagency cooperation in Topeka shiner watersheds, implementation of voluntary landowner projects on private property in Topeka shiner watersheds, and initiation of a long term monitoring program. In spite of the progress toward achieving the goals of the *Action Plan*, there has been a continued decline of Topeka shiner populations in the state. No Topeka shiners have been observed in the Bonne Femme Creek watershed since the late 1990s, despite repeated attempts to find this species.

Recovery (delisting) of the Topeka shiner in Missouri will require diligence to secure seven stable populations in the state. Achieving this goal will require a combination of: 1) re-establishment of Topeka shiners into at least five new and distinct localities, and 2) protection and enhancement of the remaining two extant populations.

Successful recovery of the Topeka shiner is entirely dependent upon the continued cooperation of private landowners along with cooperative efforts between agriculture and natural resource agencies. Use of best management practices (BMPs) on private lands in Topeka shiner watersheds should remain voluntary, and an emphasis must be made to promote cost-share practices that demonstrate an obvious benefit to the landowner.

Recovery of this species will also require a commitment of staff time and money from several agencies and groups, with MDC serving as the lead agency in this combined effort. A projected budget has been developed for the next five years (FY2011 - FY2015) to fund the Topeka shiner recovery effort.

RECOVERY GOAL STATEMENT

The recovery goal of this plan is to stabilize and enhance Topeka shiner numbers in Missouri by securing populations in seven streams. Seven populations would be equivalent to one half of the known populations sampled in Missouri since 1960. Accomplishing this goal will require the reduction or elimination of major threats and restoration of suitable habitat in Moniteau Creek and Sugar Creek watersheds, as well as introduction (or re-introduction) and establishment of secure populations in five additional streams.

RECOVERY CRITERIA

Since an approved Topeka Shiner Federal Recovery Plan does not yet exist, federal recovery criteria for this species have not yet been established. The draft Topeka Shiner Federal Recovery Plan calls for Topeka shiner populations in all six primary recovery units (PRU) to be "stable or increasing for a period of 10 years" (USFWS 2001) and a minimum of three secure populations in each of the six secondary recovery units (SRU) to delist this species. One PRU (Missouri/Grand Watershed) and a small portion of one SRU (Lower Des Moines River Watershed) are located in Missouri.

The original Missouri State Action Plan for the Topeka shiner in Missouri required securing seven stable Topeka shiner populations in Missouri streams to achieve its recovery goal (MDC 1999). Removal of this species from the state endangered species list will require downlisting or removal from the federal threatened and endangered species list.

INTRODUCTION

Fish surveys directed toward collecting the Topeka shiner (*Notropis topeka*) from 1980-1995 indicated this species had undergone a drastic decline in distribution and abundance in Missouri. As a result, the Missouri Department of Conservation (MDC) listed this species as State Endangered in 1996. This designation indicates that survival of the species in the state is considered to be in immediate jeopardy. The Missouri Topeka Shiner Working Group was formed in late 1995 and completed *An Action Plan for the Topeka Shiner (Notropis topeka) in Missouri* in January 1999 (MDC 1999). The United States Fish and Wildlife Service (USFWS) listed the Topeka shiner as endangered under the Endangered Species Act on December 15, 1998 (USFWS 1998). A federal recovery plan for this species has been drafted, but to date has not been finalized and approved (USFWS 2001). MDC is taking action to protect Missouri's remaining Topeka shiner populations and restore habitat. Missouri continues to be forefront in taking action to recover this species with MDC's efforts in determining artificial propagation techniques, cooperative efforts with other state and federal agencies and universities, implementing voluntary landowner cooperative projects, public education efforts, and commitment to a long term population monitoring program, serving as sterling examples of this commitment. This plan identifies immediate needs for protection and enhancement of the Topeka shiner and its habitat, and actions to address those needs.

DESCRIPTION

Topeka shiner

Joseph R. Tomelleri illustration
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The Topeka shiner is a small, stout minnow. This shiner species averages 1.5 to 2.5 inches in length at maturity with a maximum size around 3 inches. The head is short and the mouth does not extend beyond the front of the eye. The eye diameter is equal to or slightly longer than the snout. All fins are plain except for the tail fin, which has a chevron-shaped black spot at its base. Dorsal and pelvic fins each contain 8 rays. The anal and pectoral fins contain 7 and 13 rays respectively, and there are 32 to 37 lateral line scales. Dorsally the body is olive, with a distinct dark stripe preceding the dorsal fin. A dusky stripe runs along the entire length of the lateral line. The scales above this line are darkly outlined with pigment, appearing cross--hatched. Below the lateral line the body lacks pigment, appearing silvery-white (Gilbert 1884; Cross 1967; Pflieger 1975, 1997; USFWS 1993). Males in breeding condition have orange-red fins and "cheeks", and the dark lateral stripe diffuses.

LIFE HISTORY

Topeka shiners spawn in pool habitats over green sunfish (*Lepomis cyanellus*) and orangespotted sunfish (*L. humilis*) nests, from late May through July in Missouri and Kansas (Pflieger 1975, 1997; Kerns 1983; Kerns and Bonneau 2002; Stark et al. 2002). Males establish small territories on the periphery of these nests. It is unclear whether Topeka shiners spawn only on sunfish nests, or whether they can successfully utilize other silt free areas as spawning sites. In a fish hatchery pond environment, Topeka shiner production was greatly enhanced by the introduction of orangespotted sunfish (Rich Cook, MDC, Lost Valley Fish Hatchery, pers. comm.). Topeka shiners feed primarily on insects, such as midges (chironomids), true flies (dipterans) and mayflies (ephemeropterans), but they also are known to feed on zooplankton such as cladocera and copepoda (Kerns 1983; Kerns and Bonneau 2002). Studies from Minnesota found Topeka shiners to be omnivorous, ingesting a significant amount of plant material and detritus along with animal matter (Dahle 2001; Hatch and Besaw 2001). Topeka shiners are a schooling species found in mixed species schools consisting primarily of redfin, sand, common, and red shiners, and central stonerollers (Pflieger 1997; Kerns and Bonneau 2002). Topeka shiners live a maximum of three years, although few survive to their third summer (Kerns 1983, Dahle 2001, Kerns and Bonneau 2002). Topeka shiner populations appear to be more tolerant than other native fish species to drought conditions in Kansas (Minckley and Cross 1959, Kerns 1983, Barber 1986, Kerns and Bonneau 2002). The Topeka shiner is tolerant of high water temperatures and low dissolved oxygen levels (Koehle 2006), which may in part account for the Topeka shiner's apparent drought condition tolerance.

Green sunfish

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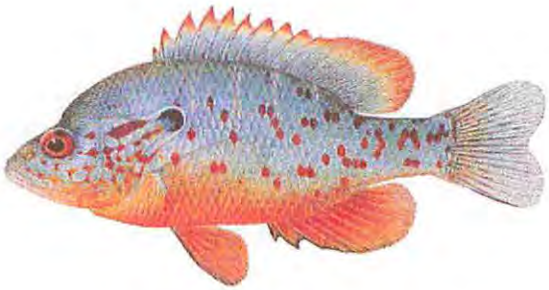

Orangespotted sunfish

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HABITAT

Topeka shiners are typically found in small, low order, prairie streams with high water quality and

cool temperatures. These streams generally flow year around; however, some may become intermittent during late summer and fall. Pool water levels and cool temperatures are maintained by percolation through the stream bed, spring flow and/or groundwater seepage when surface water flow ceases in these stream reaches (Cross 1967, Pflieger 1975, USFWS 1993). Topeka shiners generally inhabit streams with clean gravel, cobble, or sand bottoms. However, bedrock and clay hardpan covered by a thin layer of silt are not uncommon (Minckley and Cross 1959). Topeka shiners are found in pools and runs, and only rarely found in riffles. In the northern portion of its range (Iowa, Minnesota, and South Dakota), the Topeka shiner is frequently found in off channel aquatic habitat (Clark 2000; Dahle 2001; Berg, et.al. 2004). These off channel habitats are characterized by an absence of flow, moderate depth, and substrate composed of a thick silt and detritus layer (Dahle 2001; Hatch 2001). This aquatic habitat type is currently almost non-existent in prairie headwater streams in Missouri. Occasionally, individuals have been found in larger streams, downstream of known populations, presumably as migrants (USFWS 1993, 2001).

RANGE

The Topeka shiner was once widespread and abundant in headwater streams throughout the Central Prairie Region of the United States. The species' range historically included much of Missouri, Iowa, and Kansas, as well as portions of Nebraska, South Dakota, and Minnesota (Bailey and Allum 1962, Cross 1970, Gilbert 1980, USFWS 1993). In Missouri, Topeka shiners historically occurred in most of the prairie and Ozark border portion of north and central Missouri. With the exception of a population known from Cedar Creek, a tributary of the Des Moines River in Clark County (Mississippi River basin), all Topeka shiner populations in Missouri are known from the Missouri River basin. Topeka shiners have been most recently observed in the following Missouri streams: Moniteau Creek headwaters in Cooper and Moniteau counties (2009), Clear Creek (1992) and a tributary of Heath's Creek (1995) in Cooper and Pettis counties, Bonne Femme Creek watershed in Boone County (1997, although repeated attempts as recent as 2004 have failed to find the species), Sugar Creek and tributaries in Daviess and Harrison counties (2008), Dog Branch in Putnam County (1990), and Cedar Creek in Clark County (1987). The Topeka shiner in Missouri exists in highly disjunct populations in a small fraction of its historical range (Figure 1).

In Missouri, Topeka shiners once occupied portions of the Missouri, Grand, Lamine, Chariton, Crooked, Des Moines, Loutre, Middle, Hundred and Two, and Little Blue river basins. Since 1940, the species has been extirpated from many Missouri River tributaries, including Perche Creek, Petite Saline Creek, Tavern Creek, Auxvasse Creek, Middle River, Moreau River, Splice Creek, Slate Creek, Crooked River, Fishing River, Shoal Creek, Hundred and Two River, and Little Blue River watersheds (Bailey and Allum 1962, Pflieger 1971).

Sampling specifically for Topeka shiners during the early 1990s found this species at only 19% (14 of 72) of historic sites, and at only 15% (20 of 136) of total sites sampled in Missouri (Gelwicks and Bruenderman 1996). Additionally, the remaining populations found were smaller than they were historically. The isolation and small size of the remaining populations makes them highly vulnerable to extirpation. Currently, significant populations of Topeka shiners can be found in the following Missouri streams: Moniteau Creek headwaters in Cooper and Moniteau counties and Sugar Creek headwaters in Daviess and Harrison counties. Several other streams have produced samples of a few individuals in the past 25 years, but these occurrences are based on a very limited number of fish.

Extensive surveys in the Bonne Femme Creek watershed (Boone County) during 1999, 2000, and 2004 did not find Topeka shiners. At this time, it is presumed Topeka shiners have been recently

extirpated from this watershed.

REASONS FOR DECLINE

Currently, no one factor can be cited as the reason for the decline of the Topeka shiner throughout its range. Reductions and disappearance of many Topeka shiner populations appear to be related to a combination of physical degradation of habitat and species interactions. Physical degradation of habitat is primarily related to patterns of land use including destruction, modification and fragmentation of habitat, resulting from siltation, reduced water quality, tributary impoundment, and reduction of water levels. These habitat alterations may be caused by intensive agriculture, urbanization, and highway construction (Minckley and Cross 1959; Cross 1967; Cross and Moss 1987, Pflieger 1975, 1997; Tabor 1992). Bayless et al. (2003) found that generally good water quality and habitat prevailed in the Moniteau Creek watershed where the largest remaining populations of the Topeka shiner persist. No overall pattern relating Topeka shiner distribution and water quality was detectable; however, the Topeka shiner has never been observed in sub-basins of the watershed characterized by chronically extreme levels of urbanization, nutrient additions, and turbidity. Construction of watershed impoundments that limit sediment-flushing flows and provide a source of piscivorous predators, low-water crossings that obstruct animal and particle passage, and reduction of groundwater levels resulting from irrigation also may have contributed to the Topeka shiner's decline (Layher 1993, Tabor 1992, Pflieger 1997, Schrank et al. 2001, Mammoliti 2002).

Species interactions such as predation and competition with other fishes have likely played a role in the decline of the Topeka shiner in portions of its range. Stocking piscivores such as largemouth bass (*Micropterus salmoides*), crappie (*Pomoxis* spp.), and bluegill (*Lepomis macrochirus*) in ponds constructed in watersheds containing the Topeka shiner has probably sped up the decline of the Topeka shiner through predation. In addition, Pflieger (1997) suggested the introduced blackstripe topminnow (*Fundulus notatus*) and western mosquitofish (*Gambusia affinis*) may compete with the Topeka shiner for food. The Topeka shiner in Missouri has been negatively associated with largemouth bass, bluegill, and blackstripe topminnow and was part of a suite of declined fishes considered generally tolerant of poor physical/chemical conditions but intolerant of species interactions (Winston 2002). Schrank et al. (2001) found sites where the Topeka shiner had been extirpated in Kansas had a greater number of small impoundments in the watershed, longer pools, higher catch per effort of largemouth bass, and higher species diversity by trophic guild and richness compared to sites where the Topeka shiner was extant. Dahle and Hatch (2002) determined the threat of predation of Topeka shiners by piscivorous fish (including largemouth bass) in southwest Minnesota streams was low due to the rarity of such predators.

Other, unidentified factors may be responsible for the loss of the Topeka shiner from some streams including localized undocumented fish kills. Further study is needed to determine the relative significance of degradation of physical/chemical habitat versus species interactions as causes for the decline of the Topeka shiner. Koehle (2006) found Topeka shiners to be tolerant of high water temperatures and low dissolved oxygen levels. Particularly useful would be additional experimental studies that elucidate the physiological tolerances and behavior of the Topeka shiner in addition to comparisons of the hydrology, water chemistry, physical habitat, land use practices, and fish communities in areas where the species persists and where it has been lost.

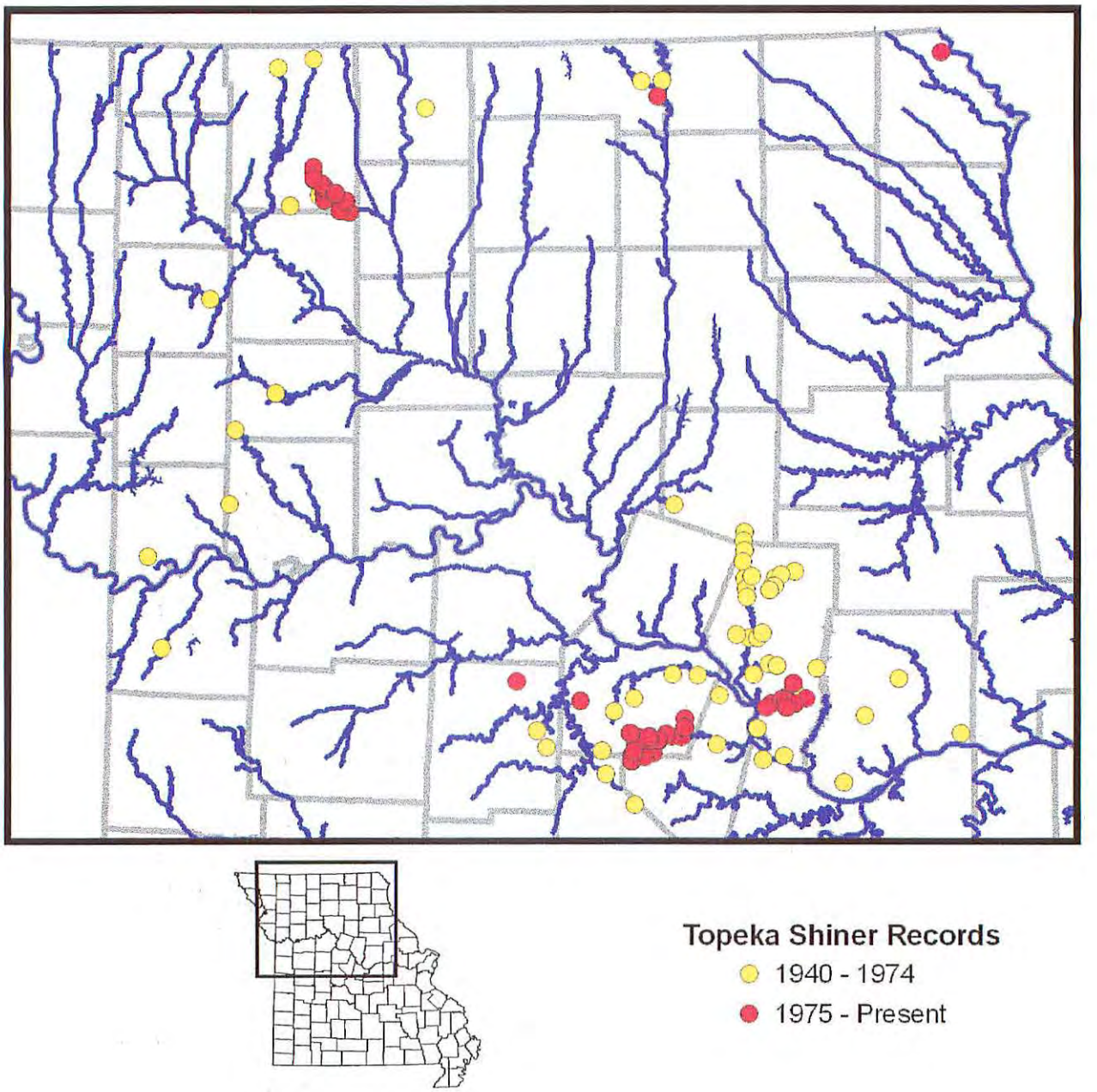

Figure 1. Geographical range of Topeka shiner in Missouri, showing historical and recent collection sites.

THREATS

Sedimentation

Topeka shiners prefer clean gravel as a spawning substrate, oftentimes in association with green or orangespotted sunfish nests (Pflieger 1997). Streams with heavy sediment loads may not be suitable for Topeka shiners if sunfish are unable to keep spawning areas free of silt and sediment. Sedimentation and turbidity may also affect the feeding ability of Topeka shiners. Since Topeka shiners feed by sight, highly turbid water may impair this shiner's ability to find food. Sedimentation can result from many different causes. Poor agricultural practices, improper timber harvest, and clearing riparian vegetation for road construction, residential development, or other activities can lead to excessive sediment buildup, high turbidity, and elevated water temperatures in streams.

Impoundments

Creation of headwater impoundments has had a negative effect on the natural hydrology of streams occupied by Topeka shiners. As water is trapped in the impoundments, it is not allowed to flush sediment from downstream reaches and maintain pool habitats required by many native fishes including the Topeka shiner.

With the creation of ponds often comes the desire by landowners to stock those impoundments with piscivorous sportfishes such as bass, bluegill, and crappie. These species may expand into stream reaches upstream and downstream of the impoundment, leading to greater predation on native stream fishes including minnows such as the Topeka shiner in particular. Topeka shiners may seek refuge in impoundments when intermittent streams begin to dry up and thereby suffer increased predation rates. Impoundments also may prevent recolonization of upstream areas by Topeka shiners following losses to drought or other factors. Even ponds that are not on the stream channel may be a source of predatory fish species that escape the impoundment during high water conditions.

Nutrient Loading

Excess input of nutrients, such as nitrogen and phosphorus, can negatively affect stream health by promoting excessive growth of algae. With the increase in algae comes an increased demand on dissolved oxygen in the stream due to respiration of the algae and decaying organic matter. Dissolved oxygen may be severely reduced in affected streams, making these streams suitable for only a few tolerant fish species. In addition, high concentrations of ammonia from animal wastes can quickly kill fish and other aquatic life.

Nutrification of streams can be caused by manure runoff from overgrazed pastures, fertilizer runoff from crop fields, spills or leakage from animal feeding operations (AFOs) or concentrated animal feeding operations (CAFOs), leaky septic tanks and inadequately treated sewage from treatment plants. Better management of nutrients at the source, and an increase in buffer area between the source and streams may be necessary to reduce nutrient input.

Point source pollution is pollution that can be traced to a particular point of origin. Potential sources are sewage treatment plants, septic tanks, airports, pipelines, industrial sites, construction sites, and highways.

For the purposes of this document nonpoint source pollution is defined as water pollution caused by rainfall or snowmelt moving over and through the ground, carrying natural and human-made pollutants into lakes, rivers, streams, wetlands, estuaries, other coastal waters and ground water. Atmospheric deposition and drainage modifications are also nonpoint sources of pollution.

Urbanization
Conversion of agricultural and forested land to commercial, industrial, and residential uses can adversely affect stream morphology and aquatic life. Urbanization often leads to increased runoff from such impermeable surfaces as roofs, roads, parking lots and driveways. Urban development also increases non-point source pollution through runoff including vehicle-related chemicals that wash from roads and driveways and pesticides and fertilizers present in runoff from residential lawns. Increasing population in urban areas increases the demand to convert land for commercial, industrial, and residential uses, and increases wastewater output.

Habitat Destruction
While many of the examples given here would be considered habitat degradation, stream channelization (=channel straightening), and in-stream gravel mining operations (when conducted improperly) lead to actual destruction of stream habitat. These alterations may eliminate clean gravel substrate; loss of stream length; accelerated bank erosion and head-cutting (which increases sediment loading); and alter stream flow thereby eliminating natural pools and riffles.

BACKGROUND INFORMATION

CURRENT LEGAL STATUS

USFWS listed the Topeka shiner as federally endangered on December 15, 1998 (USFWS 1998). A 5-year status review of the Topeka shiner listing status accuracy was initiated in 2004 (USFWS 2004). At this time the findings of the 5-year status review have been drafted but have not been published. The Topeka shiner was listed as a Missouri state endangered species in 1996.

ACCOMPLISHMENTS SINCE THE 1999 ACTION PLAN FOR THE TOPEKA SHINER IN MISSOURI

1. Annual Topeka shiner population monitoring program initiated in 1999.
2. Artificial propagation techniques under fish hatchery conditions have been developed and refined.
3. Information and format from 1999 plan was utilized as a template for the draft federal recovery plan (USFWS 2001) and several state Topeka shiner plans.
4. Three major Topeka shiner watersheds identified in the 1999 plan had Agricultural Non-point Source Pollution Special Area Land Treatment (AgNPS SALT) projects designated and implemented for each of the watersheds.
5. Outreach and education efforts directed toward the species, including a "critter" card, Best Management Practices guide sheet for Topeka shiner, three *Missouri Conservationist* articles relating to the species/affected landowners, and a video jointly produced by MDC and USFWS featuring Topeka shiner ("Helping Endangered Species Makes Dollars and Sense").
6. Participation on the Topeka Shiner Federal Recovery Team.
7. Development of a multi-agency Topeka Shiner Working Group with representation from Departments of Agriculture, Conservation, Economic Development, Natural Resources and Transportation; and the United States Fish and Wildlife Service.
8. Participation in the critical habitat designation process for the Topeka shiner in Missouri (USFWS 2005).

TEAM BUILDING AND PROGRAM DELIVERY

Meeting the goals for Topeka shiner protection and recovery will require a cooperative effort, involving multiple agencies, groups, and individual landowners. In addition to MDC, federal, state and local agencies such as the Natural Resources Conservation Service (NRCS), USFWS, U. S. Army Corps of Engineers (USCOE), Missouri Department of Natural Resources (DNR), U.S. Forest Service (USFS), Soil and Water Conservation Districts (SWCD), Farm Services Agency (FSA), Missouri Department of Transportation (MoDOT), Resource Conservation and Development Groups (RC&D), and University of Missouri Extension may become involved in this process. Local civic, community, and agriculture organizations are also likely to become involved.

Because most of the land in watersheds containing Topeka shiners is privately owned, it is imperative to foster cooperation based on mutual benefits to landowners and streams. Many practices which improve stream health, and therefore benefit Topeka shiners, also benefit the farmer or livestock owner. It is important to emphasize cooperation from landowners is strictly voluntary, and therefore benefits to landowners should be clearly stated. A number of landowner incentive programs have been set up to assist property owners in implementing Best Management Practices (BMP), which benefit both landowners and streams. Cost-share money is available for projects to improve land-use practices and stream health. Some examples of programs available are Environmental Quality Incentives Program (EQIP), Special Area Land Treatment (SALT), Continuous Conservation Reserve Program (CCRP), EPA/DNR Section 319 Nonpoint Source Grant Program, and the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program. For a list of available programs, see Appendix I. Utilizing these programs wherever possible in watersheds inhabited by the Topeka shiner will benefit Topeka shiners, overall stream health, and landowners.

Examples of BMPs include planned grazing systems, forest and grass riparian buffers, field buffers, and small wetland developments. Rotational or planned grazing systems with alternative watering sources have a clear benefit to the livestock owners in terms of productivity and pasture health. This also improves stream health by keeping livestock out of streams, maintaining riparian vegetation, and reducing runoff due to overgrazing. Contour buffers, filter strips, and grassed waterways conserve topsoil and reduce sheet and gully erosion - clear benefits to farmers, while improving stream health by intercepting sediments, fertilizers and pesticides. Most of the practices mentioned in this plan will be beneficial to the farmer and livestock owner, as well as the Topeka shiner and associated aquatic organisms.

EXTANT POPULATIONS IN MISSOURI

At the present time it is believed there are only two self-sustaining populations of Topeka shiners in Missouri. These populations are located in the Moniteau Creek watershed (in Cooper and Moniteau counties) and the Sugar Creek watershed (in Harrison and Daviess counties). These populations are monitored annually to determine their continued existence and status (i.e. declining, stable, or increasing) in these watersheds through the use of Power analysis (Appendix V, MDC 1999). These populations and the aquatic habitat in these watersheds should be protected, since they represent the last remaining naturally occurring populations of the Topeka shiner in Missouri.

Moniteau Creek Watershed

Watershed Description

The Moniteau Creek watershed covers 147,637 acres (231 square miles) in Cooper, Moniteau, and Cole counties, flowing from west to east into the Missouri River (Figure 2). The mainstem of Moniteau Creek extends 42.3 miles with headwaters just west of the town of Tipton. Major tributaries to Moniteau Creek include Smiley (7.7 miles), West (10.0 miles) and East (10.8 miles) Brush, and Little Moniteau (11.2 miles) creeks flowing from the south, and Pisgah (8.7 miles) and Howard (8.0 miles) creeks flowing from the north.

Land cover in the watershed is overwhelmingly comprised of grasslands with modest amounts of forest and croplands (Appendix II). Urban areas are limited however, the towns of Tipton, Clarksburg, and California lie along U.S. Highway 50, a route across the southern edge of the watershed, and are positioned to affect water quality in headwaters and several tributaries (Bayless et al. 2003). The western portion of the watershed includes uplands that were formerly tall-grass prairie and savanna, but have since been converted to pasture and agricultural crops. In the east, the relatively smooth uplands give way to increasingly dissected and more heavily forested ridges along major streams and in the vicinity of the Missouri River (Nigh and Schroeder 2002). Streams in the Moniteau Creek watershed are characterized by rocky substrates covered with thin silt and underlain with frequently exposed bedrock and some clay hardpan in headwaters. Groundwater maintains water levels and quality in the isolated pools of intermittent headwaters through all but the most severe droughts. Three MDC properties in the eastern portion of the watershed offer recreational opportunities for the public including Marion Bottoms (2,997 acres), Prairie Home (1,461 acres), and Roger V. and Viola Wachal Smith (517 acres) conservation areas.

Watershed Programs

During 2004, an Agricultural Nonpoint Source Special Area Land Treatment (AgNPS SALT) program was established for Cooper and Moniteau counties. This program allows county Soil and Water Conservation Districts (SWCD) to direct technical and financial assistance to landowners with land identified and prioritized as having water quality impairments attributable to agricultural nonpoint source pollution. The duration of the program is seven years. A USFWS Section 6 Grant was secured during 1997-2000. Objectives of this grant included hiring a term biologist to collect baseline information and to initiate recovery efforts for the Topeka shiner in the Moniteau Creek watershed (Tillitt 2000). Program results included direct contacts with landowners to introduce best management practices and cost-share opportunities; installation of demonstration projects and initiation of landowner projects; GIS maps showing land use, watershed attributes, Topeka shiner range, and potential threats; publications and presentations including leaflets, posters, slide presentations, newspaper articles, and video and TV segments; and an extensive survey and continued monitoring of stream fish populations in the watershed.

Historic Records (pre-1999)

The Topeka shiner has been collected from numerous locations in the upper half of the Moniteau Creek watershed including sites on the mainstem and several headwater tributaries (Figure 2). Historical records in the mainstem include collections made from the early 1960s through 1997. Collections of Topeka shiners have also been made in tributaries including East Brush Creek in 1940 and more recently in Pisgah, Smiley, and Howard creeks and an unnamed creek in the late 1990s and post-1999. Topeka shiner presence in tributaries is highly dependent on water levels as several of these small streams may become mostly dry during drought years. A major resurvey of historical collection localities was conducted by MDC staff in this watershed and other portions of former Topeka shiner range during 1995 (Gelwicks and Bruenderman 1996). Extensive, basin-wide surveys for Topeka shiners also were performed by the MDC during 1997-1999 in conjunction with implementation of a Landowner Incentive Program (LIP) project (Tillett 2000).

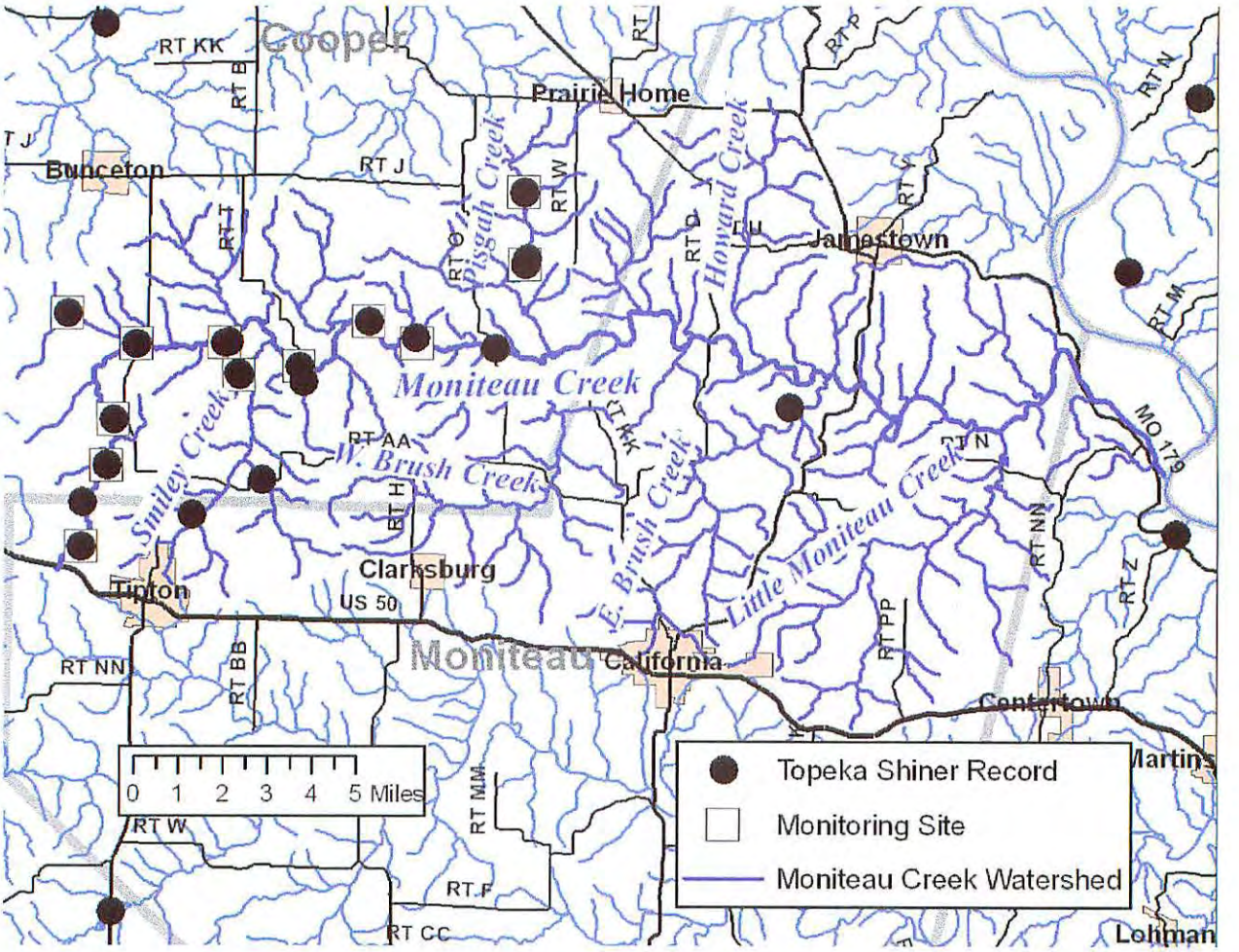

Figure 2. Moniteau Creek watershed in central Missouri showing mainstem and major tributaries; towns, major roads, and county boundaries; historical collection records for the Topeka shiner (circles); and current monitoring sites (squares).

Recent Monitoring (1999-2009)

Surveys performed during the late 1990s and a research study designed to assess associations between Topeka shiner distribution and physical, chemical, and biological factors (Bayless et al. 2003) were valuable in delineating the species' distribution in the watershed and provided baseline data used to develop ongoing monitoring programs. A plan for conducting annual monitoring of fish communities, habitat, and water quality in 12 sites in the Moniteau Creek watershed was created by MDC staff during 2000 and 2001 (Appendix V). The monitoring program includes 8 sites located on the mainstem and 4 sites on tributaries (Figure 2). Each site is 200 m in length and is sampled using a 6' to 20' long, 1/8" mesh drag seine as conditions merit. All fish are counted and Topeka shiner juveniles and adults are counted separately based on length-frequency graphs with fish total length obtained from digital photos.

Abundances of the Topeka shiner have fluctuated during 2000-2009, ranging from a low of 129 (53 adults), the total collected in all monitoring sites during 2004, to a high of 503 (40 adults) during 2006 (Figure 3). There is no indication of a significant decline in the basin-wide population, numerous young-of-the-year indicate successful reproduction, and the species' distribution in the upper watershed has been consistently broad (9 of 12 sites during 2008). A minimum of 10 consecutive

years of monitoring has been projected as necessary to document statistically significant trends in Topeka shiner abundance.

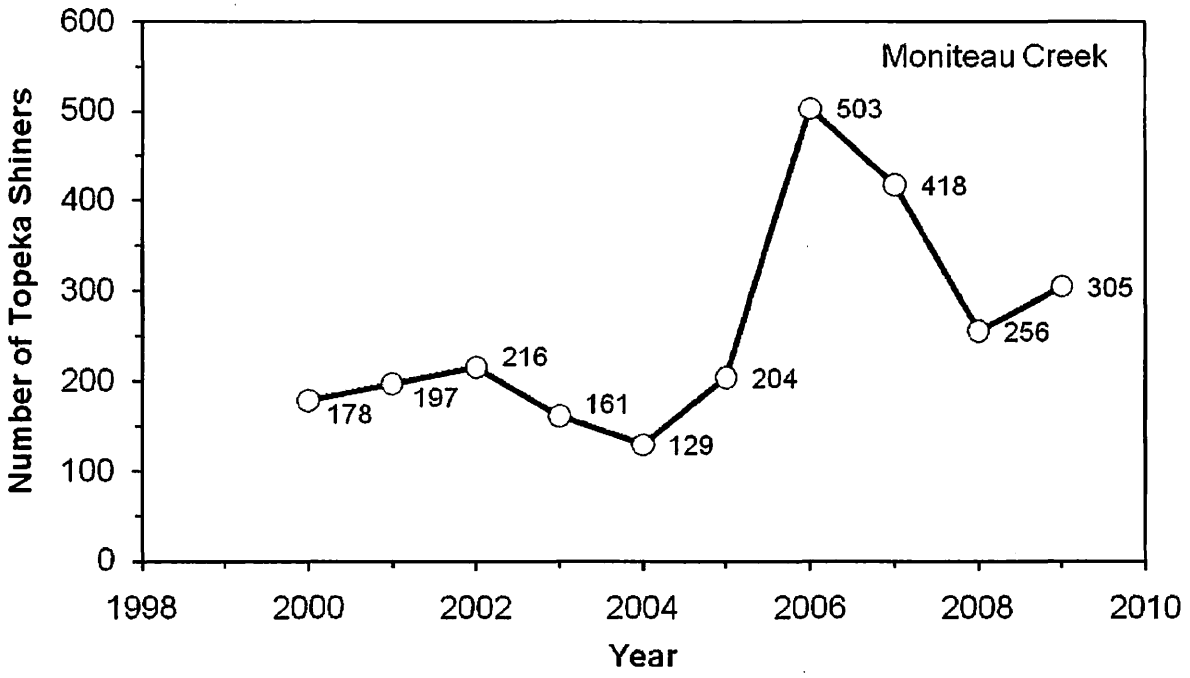

Figure 3. Number of Topeka shiners collected during Moniteau Creek monitoring surveys from 2000 to 2009.

Sugar Creek Watershed

Watershed Description

Sugar Creek originates a few miles northeast of Bethany in Harrison County and flows southeast 29 miles to its confluence with the Thompson River (Thompson River mile 30) in Grundy County (Figure 4). Major tributaries to Sugar Creek are Fox, Tombstone, and Raccoon creeks. The total watershed area is approximately 68,308 acres (107 square miles), including 117 miles of stream. The watershed is about 19 miles long and 6 miles wide. Nearly 60% of the watershed lies within Harrison County with the remainder split about evenly between Daviess and Grundy counties.

Changes in land cover in the Sugar Creek watershed reflect extensive modifications for agricultural purposes. Historically, tallgrass prairie composed 40-60% of the Sugar Creek watershed prior to European settlement in the 1800s. Upland savannas occurred on 20-30% of the drainage and existed mainly on hillsides, along draws, and on narrow ridges. Extensive areas of bottomland prairies, marshes, and shrub swamps were also found along Sugar Creek and its tributaries. Wetlands (including streams) were present on an estimated 5-15% of the drainage area (Appendix II). Presently, agriculture is the dominant land use in the watershed following the conversion of prairies, bottomland forests, and stream corridors to cropland and pastures (Appendix II). Only fragments of natural communities remain in small, isolated areas. Almost 50% of the watershed is cropland, with corn and soybeans the primary crops; however, nearly 25% of the cropland is enrolled in the USDA's Conservation Reserve Program (CRP).

Characteristics of streams in the watershed shift significantly from the headwaters to lower portions of the drainage. Streams in the upper watershed are generally shallow with emergent bedrock which has limited the extent of channelization, maintained grade control, and enhanced base flows in the drainage. However, the lower portion of Sugar Creek mainstem is channelized for 4.5 miles from the confluence with Tombstone Creek to its mouth at the Thompson River. Riparian areas are generally too narrow (<100 feet) to provide such optimum ecological functions as temperature regulation, allochthonous inputs, nutrient filtration, bank stability, floodplain roughness, and wildlife habitat. In addition, the quality of many existing corridors has been degraded by unrestricted livestock grazing.

There is no MDC-owned land within the Sugar Creek watershed, and the only public land in the drainage is limited to: 1) a small parcel of Crowder State Park near the mouth of Sugar Creek which includes a 0.4-mile stream reach and is managed by the DNR; 2) three small municipalities (pop.< 400 each); and 3) public roadways.

Watershed Programs

Two Special Area Land Treatment (SALT) projects were completed in sub-basins within the Sugar Creek drainage from 1989-94 (Tombstone Creek) and 1993-98 (upper Sugar Creek). These two SALT projects combined were designed to treat 9,080 acres of highly-erodible land with soil and water conservation practices. An Agricultural Non-Point Source Pollution (AgNPS) SALT project was completed in the entire Sugar Creek watershed from 1999-2004. The AgNPS SALT was administered by the Harrison County SWCD and afforded more flexibility and conservation practices than the conventional SALT programs. The project provided cost-share funding for 22 conservation practices, with notable participation in terrace systems (1,389 acres), nutrient/pesticide management (393 acres), grazing systems (325 acres), filter strips (285 acres), pastureland planting (227 acres), riparian buffers (39,224 linear feet), forest stand improvement (95 acres), and well plugging (12 wells). Field demonstrations, newsletters, streamside school programs, and regular educational messages through local media were included in the project.

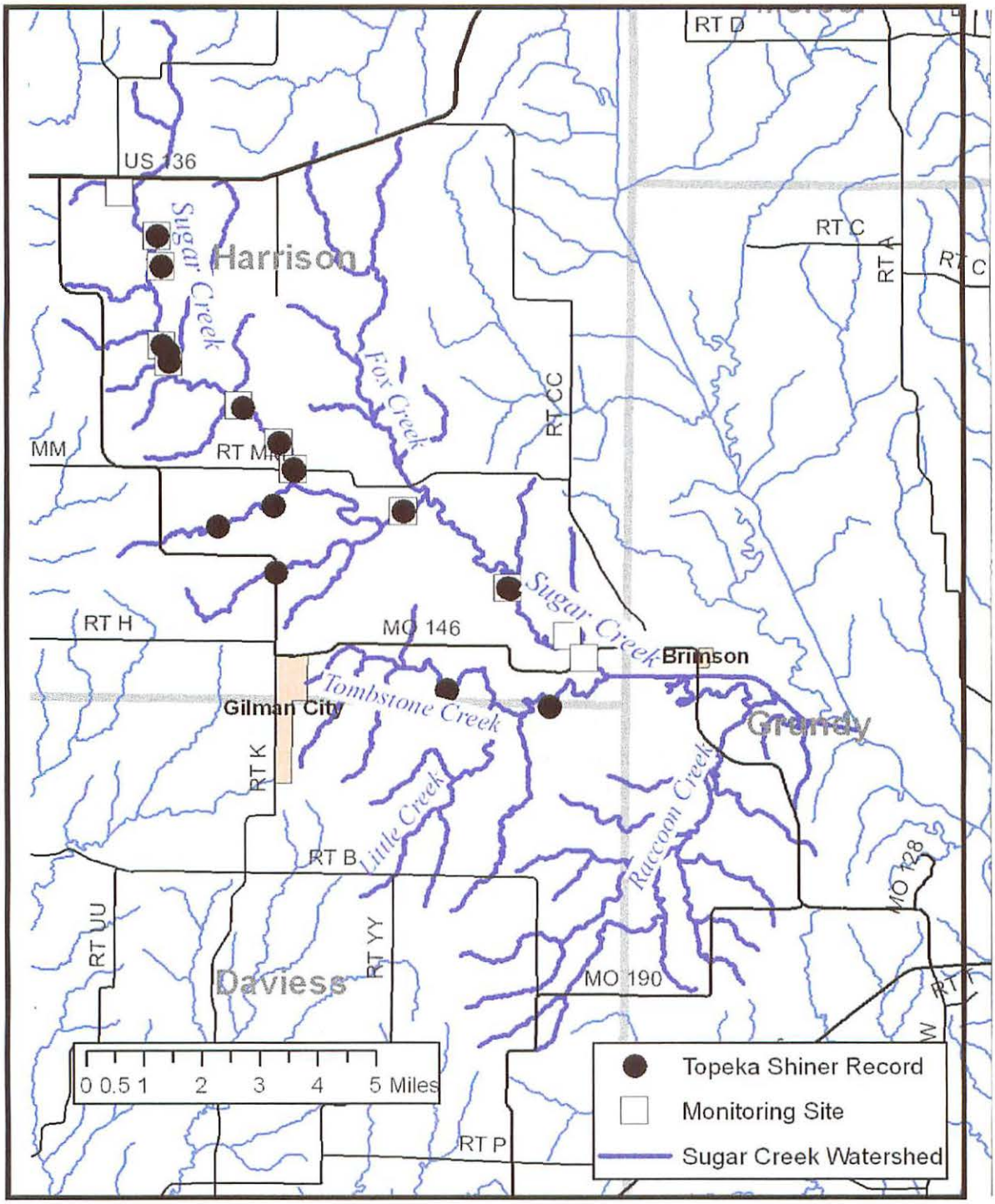

Figure 4. The Sugar Creek watershed in northwest Missouri including locations of Topeka shiner collection records and monitoring sites.

On-going watershed activities include general participation in USDA programs (now without AgNPS SALT incentives), an annual streamside field day for Harrison County 4th-graders (NRCS, SWCD, MDC), and individual cooperator projects administered by MDC (e.g., MDC cost-share, Stream Stewardship Trust Fund easements).

Historical Records (pre-1999)

Topeka shiners were collected in Sugar Creek and some of its tributaries from 1963-65; however, no estimates of abundance were recorded (White 1963; Gelwicks and Bruenderman 1996). Surveys were repeated at the same locations during 1992-96 and showed the species was present, in very low numbers, in at least two tributaries.

Recent Monitoring (1999-2009)

Under the direction of the 1999 *Action Plan*, annual monitoring of Topeka shiners was completed by MDC in the Sugar Creek watershed during 1999-2009 (Appendix V). Netting surveys were completed each fall at 12 standardized stream locations from the headwaters downstream to a site near the small town of Melbourne. Each site consisted of a 200-meter reach of stream and fish were surveyed using a 20x6-ft drag seine with 1/4-inch mesh netting. Fish species were identified and abundances were categorized as rare, scarce, common, frequent, or abundant. Only Topeka shiners and centrarchid (sunfish) species were individually counted.

The number of Topeka shiners collected in Sugar Creek (all sites combined) from 1999-2009 are shown in Figure 5. Abundances have fluctuated widely, with no Topeka shiners collected during 2008 and 2009, an extended period of excessive precipitation and some of the highest flows on record. In 2008 and 2009, surface flows were maintained in the main-stem, small tributaries, and normally dry field drainages; these conditions allowed for dispersal of an extremely low-density population. Prior to 2008, Topeka shiners were consistently observed in isolated pools at sites located higher in the drainage.

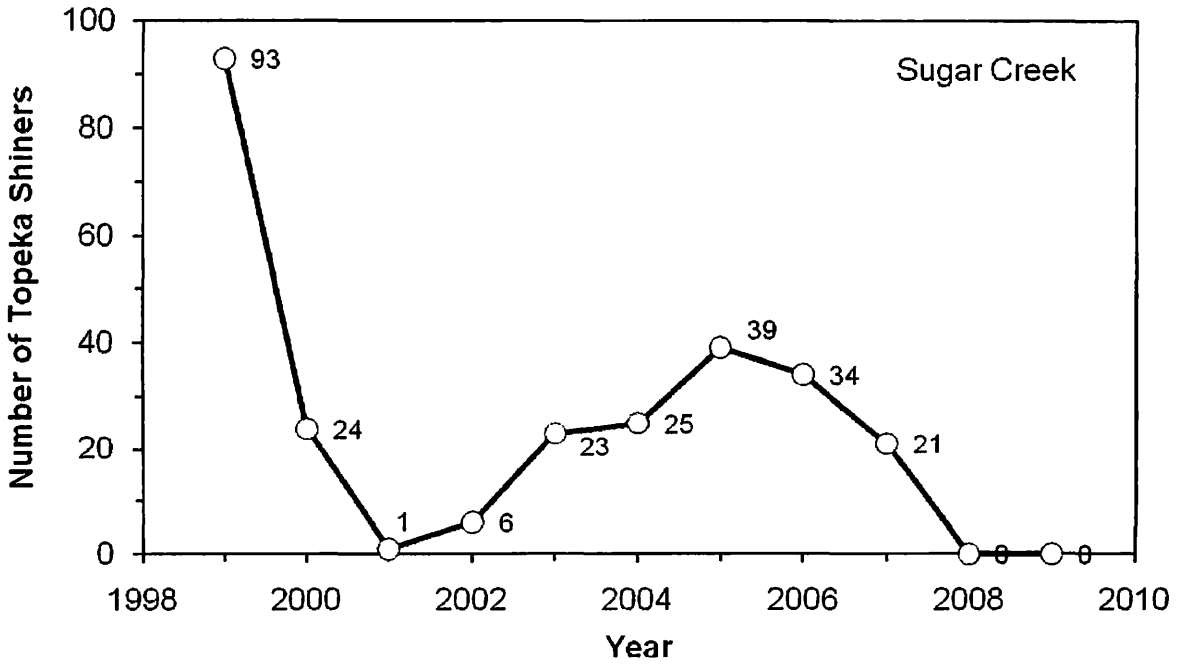

Figure 5. Number of Topeka shiners collected during Sugar Creek monitoring surveys from 2000 to 2009.

Other Populations

There are no other known self-sustaining Topeka shiner populations in existence in Missouri at the present time. There are several recent records of one or a few individuals. It is unknown whether these records indicate the existence of additional self-sustaining populations or are individuals far removed from an existing population or the last remaining individuals from populations nearing extirpation. Single Topeka shiners found in localities far from known existing populations have been previously reported for this species (USFWS 2001).

RECENTLY EXTIRPATED POPULATIONS IN MISSOURI

Bonne Femme Creek Watershed (Boone County)

Watershed Description

The Bonne Femme Creek watershed lies in southern Boone County between Columbia and Ashland, and flows southwesterly into the Missouri River (Figure 6). The watershed consists of three main streams, Bass (16.1 miles), Turkey (11.2 miles) and Bonne Femme (29.7 miles) creeks, and covers 52.3 square miles (33,472 acres). Land types are diverse with significant forest, grasslands, and croplands (Appendix II). This landscape includes former prairie, now mostly pasture and row crops, in the eastern portion of the watershed; steep-sloped, wooded Ozark hills with karst features, including caves, sinkholes, springs, and losing streams, in the central and southern portions; and great-river floodplain, primarily row crops now, and loess-covered hills along the Missouri River. The nearby urban areas of Columbia and Ashland are expanding into the watershed and are connected by U.S. Highway 63 which crosses most of the major tributaries in the upper part of the drainage. Bass, Turkey and Bonne Femme creeks are classified as Outstanding State Resource Waters. Segments of these streams can be found on two public areas, Three Creeks (1,501 acres) and Charles Green (343 acres) conservation areas.

Watershed Programs

The Bonne Femme Watershed Project (2003-2007) cost-share program offered a variety of urban/residential, karst and agricultural best management practices (BMPs) to private and public property owners in the watershed. The two main purposes of the cost-share program were to protect the watershed's streams and demonstrate the beneficial effects of BMPs. Generally, the Bonne Femme Watershed Project provided 60% of project costs. A final report of the Bonne Femme Watershed Plan is located at http://www.cavewatershed.org/ . In February 2007, DNR funded Boone County to write a watershed management plan focusing on nonpoint source water quality issues. DNR provided 60% and Boone County 40%. On-going watershed activities include general participation in USDA programs (now without AgNPS SALT incentives) and individual cooperator projects administered by MDC (e.g., MDC cost-share, Stream Stewardship Trust Fund easements).

Historic Records

Topeka shiners have been collected in the Bonne Femme Creek watershed during 1946, 1961, 1967, 1979, 1983, 1992, 1995, and 1997. A survey of the basin conducted by W.L. Pflieger, MDC biologist, in 1992 found Topeka shiners at the only site sampled on Turkey Creek, at both localities sampled on Bass Creek, and absent from the one locality sampled on Bonne Femme Creek. Another

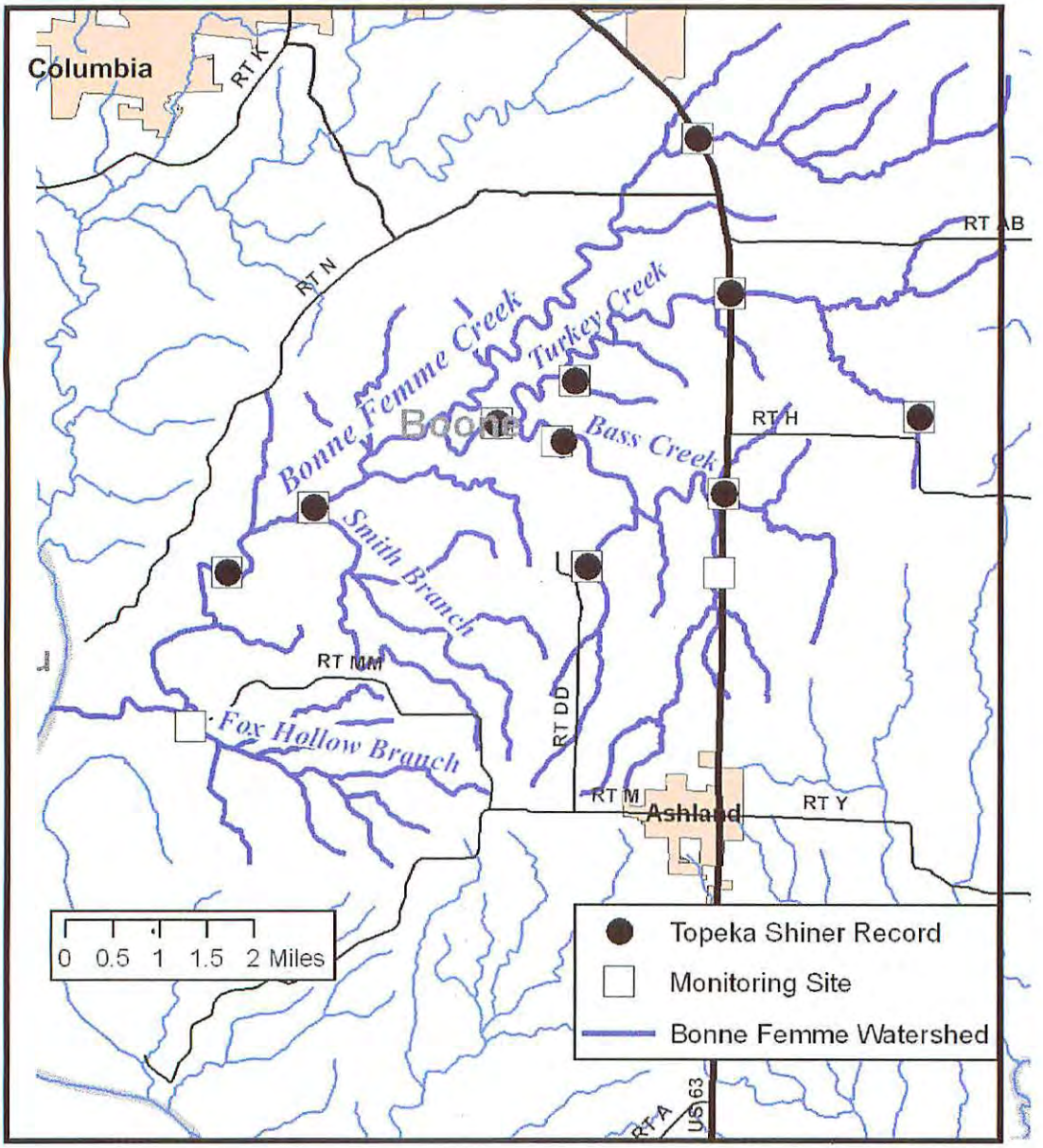

Figure 6. The Bonne Femme Creek watershed in central Missouri including locations of Topeka shiner collection records and monitoring sites.

survey in 1995 by Gelwicks and Bruenderman (1996) found the Topeka shiner at one of four localities sampled on Bonne Femme Creek, at none of the five sites sampled on Turkey Creek, and at two of four sites sampled on Bass Creek. In 1997, M.R. Winston, MDC biologist, collected Topeka shiners at one locality on Bonne Femme Creek and two localities on Bass Creek. These were the last documented collections of Topeka shiners from the Bonne Femme Creek watershed.

Recent Monitoring/Status

MDC Central Region Fisheries staff conducted annual Topeka shiner population monitoring from 1999-2001 in the Bonne Femme Creek basin. Each year sampling was done at or near the ten sites where Topeka shiners have been found previously in the basin. No specimens were collected during these sampling efforts. When Topeka shiners were not found at these sites in 1999 and 2000, sampling was expanded into a search for this species in the entire basin. Population monitoring was discontinued after no Topeka shiners were found at the ten monitoring sites in 2001. In 2004, D.

Novinger, MDC biologist, searched for Topeka shiners in the basin and was also unable to locate any specimens to document the continued existence of this species in the Bonne Femme Creek watershed.

Other Populations

Cedar Creek (Clark County)

Eighty-seven Topeka shiners were collected in a general fish community sampling project conducted in 1987 (Hrabik 1996). No additional Topeka shiners have been sampled in Cedar Creek with further sampling conducted specifically looking for this species in 1996, 1997, and 2007 (Thornhill, MDC, pers. comm.).

Dog Branch (Putnam County)

One individual Topeka shiner was collected in 1990. No water was present in Dog Branch within 300 meters of the collection site during summer of 2006 (Thornhill, MDC, pers. comm.).

PROTECTION AND RECOVERY

The recovery of the Topeka shiner in Missouri will require protection of the two existing populations and reintroduction of five or more populations to meet the recovery goal of seven secure populations in Missouri.

In Missouri, the Topeka shiner is threatened by a number of different factors which may lead to destruction or degradation of habitat. Threats may be associated with agricultural practices, commercial and residential development, and/or stocking fish species not endemic to headwater streams. These threats may result from direct alteration to a stream, or the result of processes taking place some distance from a stream. Most of the actions that must be taken to recover Topeka shiner populations in Missouri involve reduction of non-endemic fish predation and competition, and habitat protection and restoration. Suitable habitat must be available before other means of Topeka shiner recovery, such as captive propagation and reintroduction will be successful.

PROTECTION/ENHANCEMENT OF EXTANT POPULATIONS

Cooperative efforts to enhance streams and riparian areas by targeting landowners in watersheds containing Topeka shiners must be continued and improved to encourage additional participation. These programs and practices must have obvious benefits to landowners or provide a significant financial incentive to secure a higher level of participation than currently observed.

Conservation efforts directed at enhancement of privately owned property through voluntary programs will continue to be the primary focus of Topeka shiner recovery effort in Missouri. Additionally, there may be situations where the purchase of conservation easements or fee title purchase of property from willing sellers may be necessary to implement the best recovery effort possible for the Topeka shiner in Missouri.

OTHER SPECIES BENEFITING FROM TOPEKA SHINER RECOVERY EFFORTS

Several other species of conservation concern dependent on small prairie streams should benefit from recovery actions directed at Topeka shiner populations and habitat.

The trout-perch (*Percopsis omiscomaycus*) is listed as a critically imperiled species in Missouri (Missouri Natural Heritage Program 2008) and can be found in prairie streams with the Topeka shiner. The trout-perch "seems to be especially sensitive to pollution and sedimentation" (Pflieger 1997) and its reduction in range has been attributed to the loss of pool habitat. Certainly pool habitat loss in prairie streams is a contributory factor in the reduction of available Topeka shiner habitat.

The blacknose shiner (*Notropis heterolepis*) inhabits small prairie streams in central and west-central Missouri. Declining numbers of this species, presumably due to habitat degradation and loss, has resulted in its listing as an imperiled species in Missouri (Missouri Natural Heritage Program 2008).

REINTRODUCTION

A list of streams have been identified for possible Topeka shiner reintroduction based on a number of factors including (but not limited to) public ownership, ownership by a conservation partner, proximity to existing Topeka shiner population, historic range of the species, overall condition of stream and watershed, and the perceived likelihood of success of the reintroduction.

Since a reintroduction of the Topeka shiner (and few other minnow species) has never been attempted, there will be considerable experimentation and evaluation to determine the best methodology to enhance the possibility of success for Missouri's overall reintroduction efforts. The primary reintroduction sites have been picked based upon the proximity to publicly owned and conservation partner owned property on which access (to evaluate effectiveness of techniques) will be readily available throughout the course of the project. Although the exact details of the reintroduction process have yet to be resolved, Topeka shiners will be stocked into the identified streams, and fishless ponds adjacent to streams to serve as refuges and sources of future stream stockings. These ponds should serve as surrogate off-channel habitat that is almost non-existent in Missouri, but is very important to the species in the northern portions of its range. In addition to Topeka shiners, orangespotted sunfish will be stocked into the ponds to enhance reproduction of the Topeka shiners. Orangespotted sunfish are part of the fish fauna in the streams at each of the primary reintroduction sites. Other sunfish species (i.e., green sunfish) may be used at other reintroduction sites if orangespotted sunfish are not present.

This reintroduction effort is necessary to recover the Topeka shiner in Missouri. The participants in this activity will work with local citizens to minimize impacts of these reintroductions. Public comment opportunities related to these reintroductions will be provided.

PRIMARY REINTRODUCTION SITES (Tier 1) – Figure 7

East Fork Big Muddy Creek (Gentry, Harrison, and Worth counties)

Watershed Description

East Fork Big Muddy Creek is a tributary to Big Muddy Creek and the greater East Fork Grand River. The reintroduction area will extend from the mouth of Big Muddy Creek at the confluence with the East Fork Grand River in Gentry County (Section 12, Township 61 North, Range 31 West), upstream to the headwaters of East Fork Big Muddy Creek in Harrison County (Section 14, Township 66 North, Range 29 West) and will include all tributaries in this reach from mouth to headwaters (Figure 7). This drainage covers nearly 45,000 acres or 70 square miles, with approximate dimensions of 19 miles long by 5 miles wide. Specific reintroduction sites will be located in free-flowing, headwater stream reaches and in select ponds (>8 feet deep) on Pawnee Prairie Natural Area (NA). This 475-acre Natural Area, within the Central Tallgrass Prairie Ecoregion, is one of the core public ownerships within the Grand River Grasslands Conservation Opportunity Area. Pawnee Prairie NA is owned and managed by MDC to restore a diverse prairie community, both plant and animal. Except during periods of extreme drought, pool habitat is maintained in select stream reaches on the area through surface runoff, springs and seeps.

Suitability

Streams on Pawnee Prairie NA appear well-suited to support Topeka shiners; however, limited pool habitat may be critical during extreme winters and extended drought periods. In 2004, natural riffles were elevated by adding rock at four locations, and stream crossings were constructed or improved at four additional locations, to create and/or enhance a total of eight pools within a one-mile reach of the creek. Three small ponds, and all stream reaches which currently sustain fish populations, will be renovated with rotenone to remove predator fishes. Ponds will serve as refugia for Topeka shiners during extreme drought, and with the addition of appropriate spawning gravels, have the potential to support significant reproduction and recruitment into downstream reaches.

Little Creek Headwaters (Harrison County)

Watershed Description

Little Creek watershed, located in northwest Harrison County, is a tributary to West Fork Big Creek in the greater Grand River drainage. The upper watershed may be characterized as open, rolling grasslands with small woodlots restricted to steep draws and a few isolated stream corridors. Land use is entirely agricultural with cattle grazing and hay production predominant. Wooded riparian habitat is limited and streambank stability is poor in many areas. The only public property is associated with Harrison County's 280–acre water supply reservoir located on 840 acres in the upper portion of the Little Creek drainage. The designated reintroduction area will extend from the backwaters of Harrison County Reservoir (Section 20, T.65 North, R. 28 West, approximate River Mile (RM) 14) upstream to the headwaters of Little Creek (Section 19, T.66 North, R.28 West, approximately RM 22.1) and will include all tributaries in this reach from the reservoir to headwaters (Figure 7). This area covers an estimated 7,600 acres or 11.8 square miles, with approximate dimensions of 6 miles long and 3 miles wide. Specific reintroduction sites will be located in headwater stream reaches and in select ponds (>8 feet deep) on property known as Dunn Ranch, which is owned by The Nature Conservancy (TNC). TNC manages the nearly 3,000-acre property to

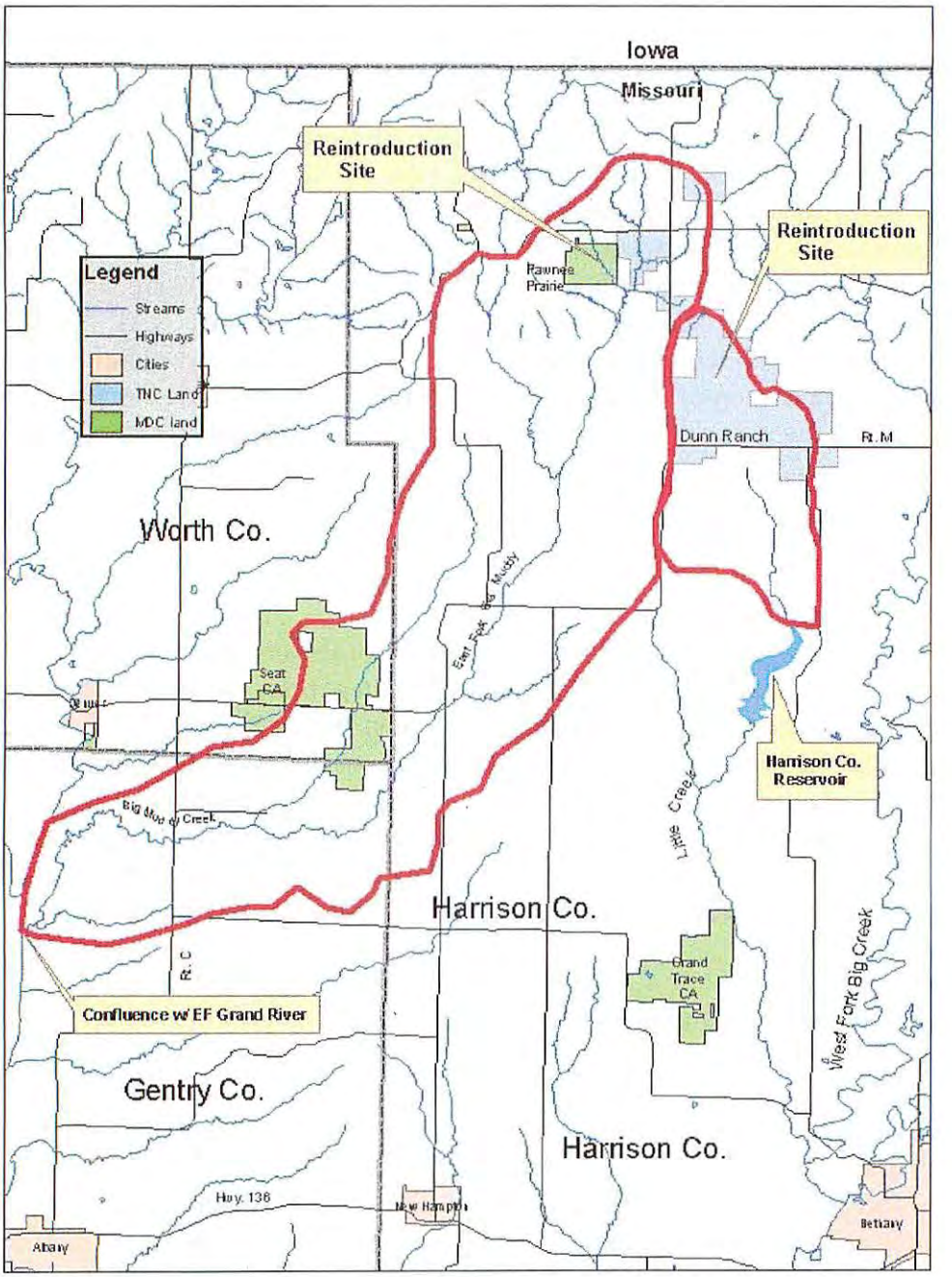

Figure 7. Proposed non-essential experimental areas and reintroduction sites for Topeka shiners in the Big Muddy Creek and Little Creek watersheds in Harrison, Gentry, and Worth counties.

restore and protect native diversity of the Central Tallgrass Prairie ecoregion, and to serve as "core" property within the Grand River Grasslands Conservation Opportunity Area. Nearly all of the headwaters of Little Creek and over twenty smaller ponds are included on Dunn Ranch. Except during periods of extreme drought, pool habitat is maintained in some lower stream reaches on Dunn Ranch through surface runoff, springs and seeps.

Suitability

In addition to the natural attributes of this headwater site, efforts to improve suitability of the Dunn Ranch property for the proposed reintroduction have been ongoing for a few years. In 2001, MDC completed a series of riffle enhancements (elevated riffle heights) within a ¼-mile stream reach to increase pool depths and sustainability. In 2004, rotenone renovations were completed to remove predator fish from all suitable ponds. Potential for reestablishment of predator populations in streams is minimized by road culverts on the ranch boundary which act as barriers to natural fish migration from downstream reaches. Ponds on Dunn Ranch will serve as refugia for Topeka shiners during extreme drought, and with the addition of appropriate spawning gravels, have the potential to support significant reproduction and recruitment into downstream reaches. A cooperative agreement between MDC and TNC was also completed in 2004 which restricts re-stocking of predator fishes and allows MDC to conduct appropriate reintroduction and monitoring activities.

Section 10(j) of the Endangered Species Act requires a Non-Essential Experimental Population (NEP) to be geographically separate from other wild populations of the same species. The proposed Little Creek NEP of Topeka shiners will be totally isolated from existing populations of this species by a reservoir (280 acres), and this fish species is not known to occur in or move through a reservoir of this size that contains predatory fish species. Therefore, this reservoir will act as a barrier to the species' downstream movement into the Grand River and its tributaries and ensure this NEP remains geographically isolated and easily distinguishable from existing wild populations. Based on the species' habitat requirements, Topeka shiners are not expected to become established outside the NEP area. However, if any of the reintroduced Topeka shiners move downstream or into tributaries outside the designated NEP area, then the animals would be considered endangered as provided by the Act and presumed to have come from the NEP area. In that case, MDC would propose to amend the rule and enlarge the boundaries of the NEP area to include the entire range of the expanded population.

Unnamed Tributaries of Spring Creek (Adair, Putnam, and Sullivan counties)

Watershed Description

Unnamed Stream 1 is a second order tributary of fourth order Spring Creek, which is located in the Chariton River Basin in Adair and Sullivan counties. The watershed of Unnamed Stream 1 is approximately 1,181 acres. Private land ownership within the watershed consists of approximately 251 acres (21.3% of the total watershed). Public land ownership (Union Ridge Conservation Area) accounts for the remaining 930 acres (78.7% of the total watershed). Land cover within the public land is dominated (905 acres, 97.3% of public land within watershed) by natural vegetation types—prairie, prairie/savanna, and forest. Cultivated fields/food plots (23.6 acres, 2.5% of public land within watershed) and impounded water (1.4 acres, 0.2% of public land within watershed) represents the other land cover types.

Unnamed Stream 1 is a naturally meandering stream with an apparently channelized reach near its confluence with Spring Creek. Incision is mostly limited to this lower reach due to the presence of

multiple bedrock outcroppings and abundant beaver dams. Streambank heights range from a few feet to over eight feet. The majority of the streambanks appear to be stable. Streambed substrate is dominated by clay, silt, and sand, but also includes areas of gravel, cobble, boulders, and bedrock. Large woody debris (median diameter ≥ 4 in. and length ≥ 6 ft.), small diameter woody debris (median diameter < 4 in.), and aquatic vegetation (algae, naiads, coontail, etc.) are also present within the stream channel. Water depths range from a few inches in riffles to over six feet in several of the pools. Water clarity is variable and is lowest in areas of greatest beaver activity.

The riparian corridor width and composition varies with elevation and distance from the mouth of Unnamed Stream 1. Near the stream's confluence with Spring Creek, the riparian corridor consists of mature, bottomland timber and measures at least 100 feet wide from the top of bank. As Unnamed Stream 1 exits the Spring Creek floodplain, the riparian corridor is dominated by willows and grasses. Riparian corridors for upland tributaries to Unnamed Stream 1 vary from mature upland forests to native warm season grasses to shrub thickets. There are stream reaches along three food plots where the buffer between field cultivation and the top of streambank measures less than 100 feet. Other areas lacking wooded riparian corridors have been left idle to reforest naturally.

A total of 21 fish species (including two different types of sunfish hybrids) from five different families—Catostomidae, Centrarchidae, Cyprinidae, Ictaluridae, and Percidae—were sampled in Unnamed Stream 1 during summer 2005. The three fish families that accounted for approximately 98% of the sample (by number of individuals) were Centrarchidae (n=3,130, 55.8%), Cyprinidae (n=1,853, 33.0%), and Ictaluridae (n=508, 9.1%). Topeka shiners are known to use the nests of Centrarchids to spawn.

Unnamed Stream 2 is a first order tributary of fourth order Spring Creek and is located immediately east of Unnamed Stream 1. The watershed of Unnamed Stream 2 is approximately 336 acres. The entire watershed is within the Union Ridge Conservation Area. Land cover is dominated (335.4 acres, 99.8%) by natural vegetation types—prairie, prairie/savanna, and forest. The remaining land cover type is represented by impounded water (0.6 acres, 0.2%).

Unnamed Stream 2 is a naturally meandering stream with an apparently channelized reach near its confluence with Spring Creek. Incision is mostly limited to this lower reach due to the presence of multiple bedrock outcroppings and abundant beaver dams. Streambank heights range from a few feet to over eight feet. The majority of the streambanks appear to be quite stable. Streambed substrate is dominated by clay, silt, and sand, but also includes areas of gravel, cobble, boulders, and bedrock. Large woody debris (median diameter ≥ 4 in. and length ≥ 6 ft.), small diameter woody debris (median diameter < 4 in.), and aquatic vegetation (algae, naiads, coontail, etc.) are also present within the stream channel. Water depths range from a few inches in riffles to over four feet in several of the pools. Water clarity is variable and is lowest in areas of greatest beaver activity.

The riparian corridor width and composition varies with elevation and distance from the mouth of Unnamed Stream 2. Near the stream's confluence with Spring Creek, the riparian corridor consists of mature, bottomland timber and measures at least 100 feet wide from the top of bank. As Unnamed Stream 2 exits the Spring Creek floodplain, the riparian corridor is dominated by willows and grasses. Riparian corridors for upland tributaries to Unnamed Stream 2 vary from mature upland forests to native warm season grasses to shrub thickets.

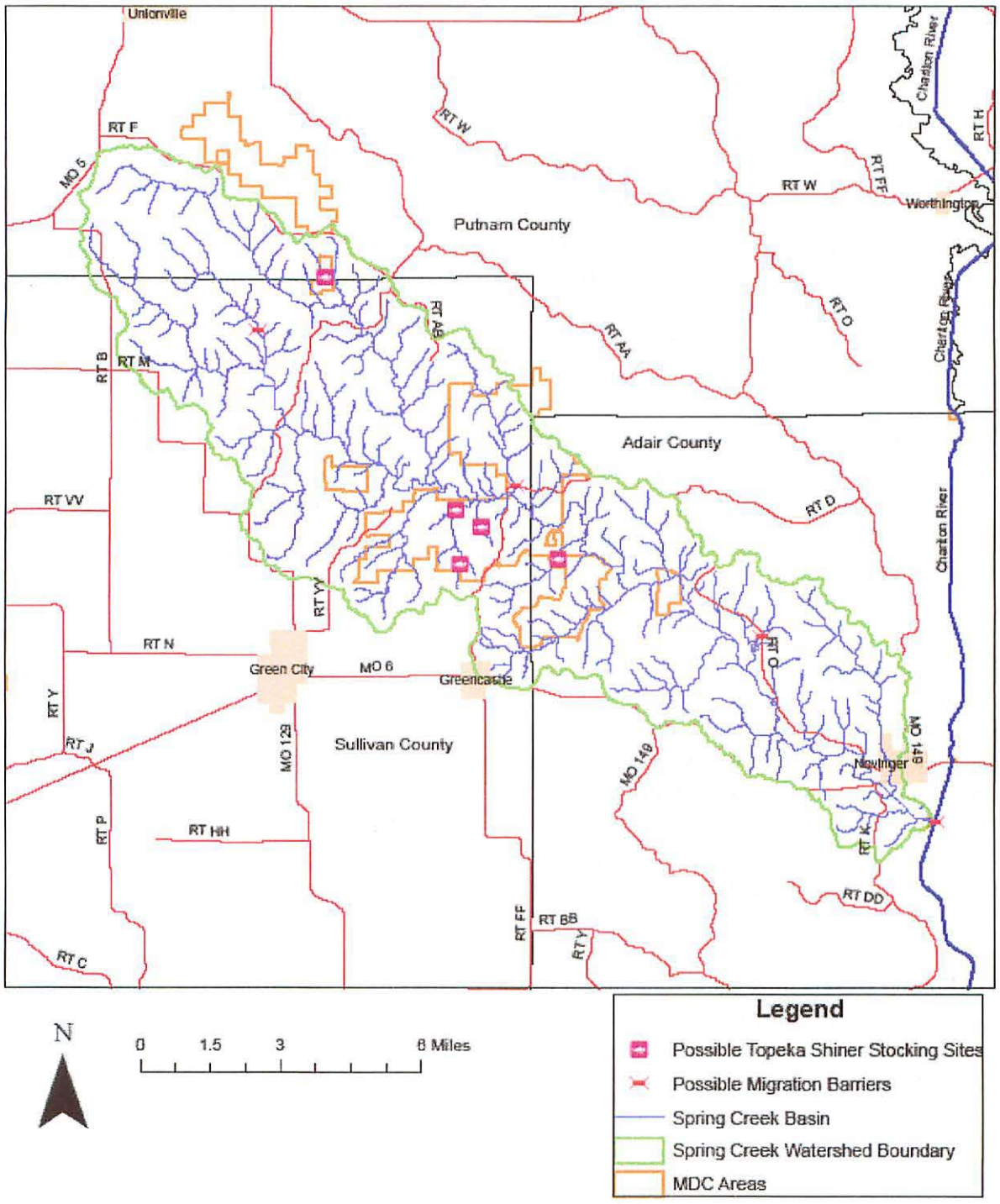

Figure 8. Proposed non-essential experimental areas and reintroduction sites for Topeka shiners in the Spring Creek watershed in Adair, Putnam, and Sullivan counties.

SECONDARY REINTRODUCTION SITES (Tier 2) – Figure 9

Heath's Creek (Pettis County)

Watershed Description
Heath's Creek is located in northern Pettis County and flows northwest into the Lamine River. The 71,000-acre watershed was selected as an aquatic COA due to a relatively diverse aquatic fauna. The watershed is primarily agricultural in the upper half with an increasing amount of timber in the lower half. At times, water quality has been a problem and has resulted in fish kills. Nutrient input from CAFOs poses some problems in this watershed. Topeka shiners have been found in the Heath's Creek watershed as recently as 1995 when three fish were found in Greer Branch. More recent samples have not found any Topeka shiners. There is very little public land in the watershed.

Suitability
Because Topeka shiners were found in the watershed within the last 20 years, this is probably a reasonable choice for a reintroduction site. Obviously, Topeka shiners disappeared for a reason so reintroductions will need to follow work in the watershed. Urbanization is not a major problem in this watershed but water quality issues, poor riparian corridors, and other land use problems will need to be addressed.

Logan Creek (Callaway County)

Watershed Description
Logan Creek occurs in southeastern Callaway County and flows generally north to southwest along the eastern boundary of Reform Conservation Area to the Missouri River. It flows approximately twelve miles from its headwaters west of Readsville to the Missouri River about one mile west of Portland. Logan Creek is a 4th order stream where it joins Mud Creek in the Missouri River floodplain and then becomes a 5th order stream. The Logan Creek watershed is approximately 27.2 square miles or 17,432 acres. Much of the land cover in the watershed is forest with many ridge tops in pasture and creek bottoms in pasture and row crops. Much of the upland area in the headwaters of Logan Creek and in the west central part of the basin is also in row crops. The MDC fish database contained fish sampling records for two sites sampled in 1995 in the 4th order reach of Logan Creek, one in the lower part of this section and the other about two miles upstream. No Topeka shiners were found but blacknose shiners, a species of conservation concern, were found at the upper site.

Suitability
This stream was chosen as a potential reintroduction site because Topeka shiners have historically occurred in the vicinity (see Meyers Branch of Tavern Creek) and some of the stream and its watershed occur on public land – Reform Conservation Area.

South Fork Flat Creek (Pettis County)

Watershed Description
South Fork Flat Creek is located in southern Pettis County and flows north into the Lamine River. Topeka shiners have never been sampled in the South Fork Flat Creek watershed. The stream is in relatively good condition, however, with most of the watershed in grass. Because of the relatively high quality habitat, this stream was selected as an Aquatic Conservation Opportunity Area (COA).

Blacknose shiners, a species of conservation concern, were once abundant in the watershed, but limited sampling has not found any in the past 20 years.

Suitability
This watershed is mostly grass and the stream has relatively good habitat. Although Topeka shiners have never been found in this watershed, the habitat seems to be suitable. Blacknose shiners and Topeka shiners have been found together elsewhere and reintroduction efforts and associated habitat work could benefit both species.

Tavern Creek (Callaway County)

Watershed Description
Tavern Creek is located in southeastern Callaway County and flows generally north to south approximately eight miles to the Missouri River. Its headwaters begin just east of Readsville and it joins the Missouri River about one and a half miles east of Portland. Tavern Creek is a 3rd order stream with its two main tributaries, Means and Meyers branches, 2nd order drainages. The Tavern Creek watershed is approximately 15.2 square miles or 9,701 acres. Land cover in the watershed is mostly forest with pasture and row crops to a lesser extent along the larger streams and at their headwaters. Topeka shiners were sampled in Meyers Branch near its confluence with Tavern Creek in 1941; 14 specimens were collected at this site. Since 1941, sampling was conducted in Tavern Creek near the mouth of Meyers Branch in 1992 and 1995, but no Topeka shiners were found.

Suitability
This stream was chosen as a potential reintroduction site because it historically had Topeka shiners; local MDC staff have worked with numerous watershed landowners installing conservation practices and believe landowners would be receptive to a reintroduction; and the watershed is lightly populated and developed. In addition, the stream continues to support a rich headwaters/small creek fauna including plains topminnows and blacknose shiners, both species of conservation concern.

TERTIARY REINTRODUCTION SITES (Tier 3) – Figure 9

Clear Creek (Cooper County)

Clear Creek's headwaters begin just north of New Lebanon in southwestern Cooper County and flow approximately 13 miles to its mouth at the Lamine River. The watershed for Clear Creek and its tributaries, Taylor Branch and Skull Creek, is approximately 20 square miles. The headwater land use is mainly pasture and upland forest, while the lower watershed is mostly row crops with some pasture and forest. The upper stream channel is composed mostly of bedrock and cobble transitioning into gravel and silt substrates as it flows nearer to its confluence with the Lamine River. Clear Creek was sampled in 1972 and 1992 and one Topeka shiner was collected during each sampling effort. This stream was observed from road crossings during October 2006. The headwaters did not appear to have any water, there were intermittent pools in the mid-section of the stream reach, and there were large pools at the last road crossing near the mouth. This stream appears to be healthy and scores high on the Topeka shiner predictive model designed by MDC Resource Scientist Doug Novinger.

Factory Creek (Moniteau County)

Factory Creek is located in the northern portion of Moniteau County and flows west to east with headwaters located north of Jamestown. Factory Creek is an approximately eight mile long, direct tributary of the Missouri River. The Factory Creek watershed is approximately 11 square miles. This stream was visually observed at the Factory Creek Road crossing and upstream at Possum Trot Hollow Road crossing and the stream appeared to have an adequate amount of water in a series of intermittent pools. The stream substrate was mainly cobble with some bedrock. The watershed is a mixture of row crop, pasture, old field, and upland timber. All of the middle reach of this stream is owned by a single landowner who is not interested in allowing MDC staff access to the stream for sampling efforts.

Lake Creek (Benton and Pettis counties)

Topeka shiners have never been found in this 31,457-acre watershed although sampling has been limited. Much of the riparian corridor is in trees and grass and the stream is in relatively good condition. Much of the cropland in the watershed is located along the stream, however, and bank erosion is prevalent in places. There are no obvious reasons for excluding this stream as a potential reintroduction site.

Otter Creek (Cooper County)

Otter Creek in southwestern Cooper and northern Morgan counties flows approximately nine miles from near Syracuse northwesterly to the Lamine River. The lowermost reach of Otter Creek is within the boundary of MDCs Lamine River CA. Otter Creek is a 3rd order stream with no named tributaries. The Otter Creek watershed encompasses 18.4 square miles (11,750 acres). Land cover in the watershed is mostly pasture and forest. A single Topeka shiner was collected in a middle/upper main-stem reach of Otter Creek in 1961 and is the only record of occurrence of this species in the watershed. Fish community sampling in the watershed since the 1950s documented a diverse fish fauna including the occurrence of carmine, red, sand, and western redfin shiners, fishes often associated with the Topeka shiner. This stream was chosen as a potential reintroduction site because it historically had Topeka shiners; its lower reach is located partially and some segments entirely encompassed on Lamine River Conservation Area; and the watershed is lightly populated and relatively undeveloped.

Richland Creek (Morgan County)

Richland Creek is located in northern Morgan County and flows approximately 22 miles from near Versailles to the north and northwest to join the Lamine River within the boundary of MDCs Lamine River CA. Richland Creek has several tributaries, including: Messer Creek, Big Branch, Middle Richland Creek, Little Richland Creek, Gabriel Creek, and Spring Branch. The Richland Creek watershed encompasses approximately 138 square miles (88,340 acres). Land cover in the watershed is mainly row crop in the floodplain and forest and pasture in the upland areas. The stream is in relatively good condition, and because of the relatively high quality habitat, this stream was selected as an Aquatic COA. During 1969, two Topeka shiners were collected in Little Richland Creek near the confluence with Richland Creek; that was the only record of the species in the watershed. Similar

to Otter Creek (above), fish community sampling in the watershed since the 1950s documented a diverse fauna including the occurrence of carmine, red, sand, and western redfin shiners, fishes often associated with the Topeka shiner.

Rock Creek – (Cole County)

Rock Creek in the northwestern portion of Cole County flows from southwest to northeast with its headwaters north of Centertown flowing approximately seven miles to the Missouri River. The Rock Creek watershed is approximately 7.5 square miles (4,772 acres). Topeka shiners were last sampled in Rock Creek in 1940 when 13 individuals were collected. A segment of the middle reach was sampled again on September 14, 2006 during which no Topeka shiners were found. During the September 2006 inspection this stream had very little water and the water that was found was of low quality. Fish sampled in the stream included western mosquitofish and bullhead catfish. Most of the watershed appears to be pasture and upland forest. Cattle appear to be having an adverse impact on this stream.

Splice Creek – (Moniteau County)

Splice Creek in the northern portion of Moniteau County flows from west to east with headwaters located just northeast of Prairie Home. This direct tributary of the Missouri River flows approximately 11 miles to its mouth at the Missouri River. The Splice Creek watershed consists of approximately 17.58 square miles or 11,253 acres. Land cover in the watershed is mainly pasture and forest with row crops to a lesser extent. Topeka shiners were last sampled in Splice Creek in 1961 when nine individuals were collected. The stream has been sampled since (1992), and no Topeka shiners were been found. This stream was chosen as a potential reintroduction site because it historically had Topeka shiners and a private landowner/conservation cooperator in the middle reach of the stream with 2,200 acres is willing to facilitate a reintroduction effort on the property.

Turtle Spring Branch – (Moniteau County)

Turtle Spring Branch is a second order tributary to Little Moniteau Creek. Its headwaters are located in east central Moniteau County north of Highway 50 east of McGirk, and flow north for approximately 4.5 miles to its confluence with Little Moniteau Creek. The watershed for Turtle Spring Branch is approximately 4.32 square miles and is composed of mostly pasture land and upland forest and a small amount of row crops. A segment of this stream was sampled on the Roger V. and Viola Wachal Smith Conservation Area during September 2006. During the investigation the stream was found to be mostly dry with a few intermittent pools of water holding common shiners, creek chubs, orangethroat darters, and bluegill. The reach of stream on the conservation area had a very limited amount of water and would be considered a low priority area to reintroduce Topeka shiners.

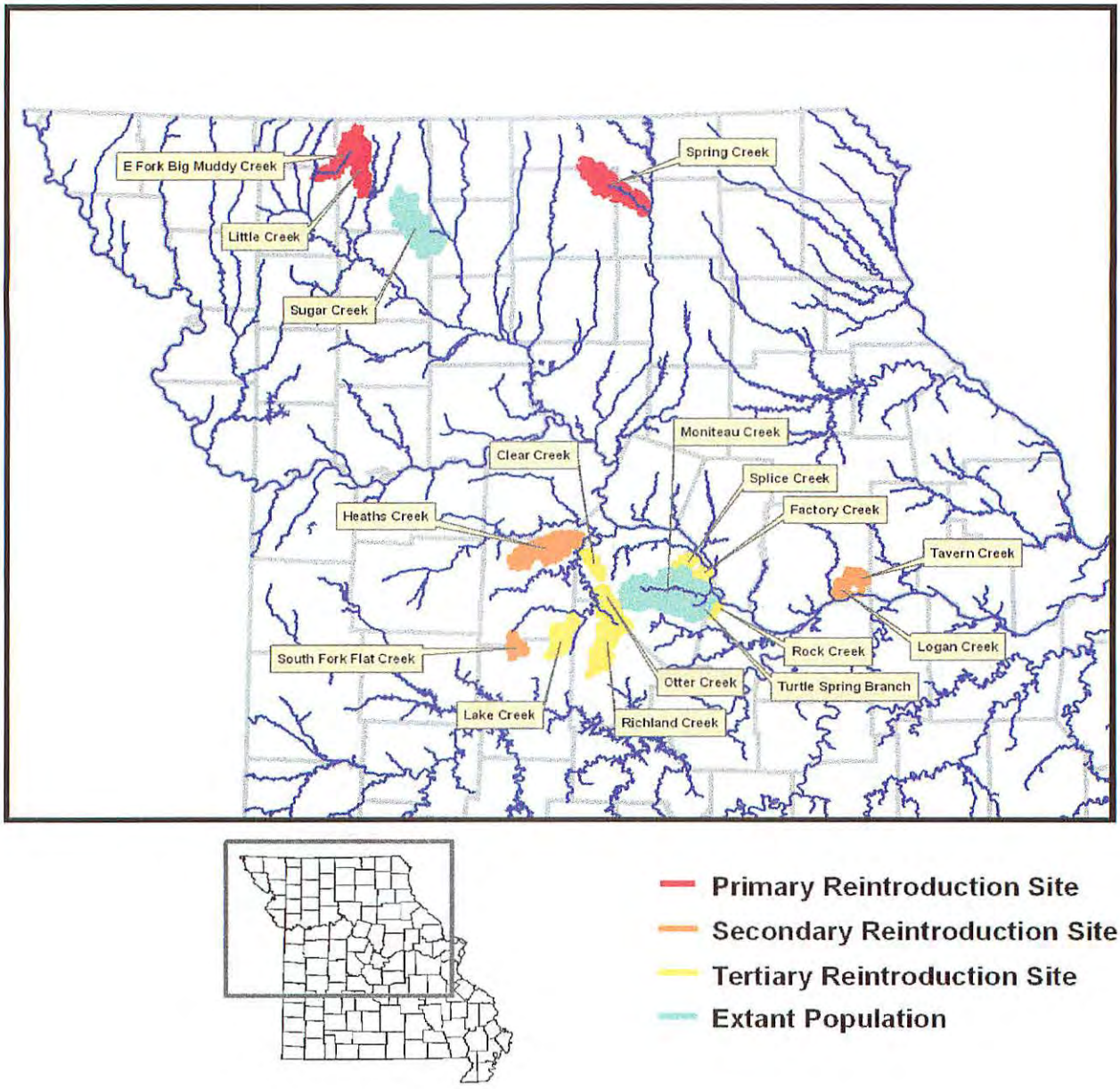

Figure 9. Map of possible Topeka shiner introduction sites.

RECOVERY OBJECTIVES AND STRATEGIES

Objective 1: Reduce sedimentation and stream bank erosion in watersheds containing Topeka shiners.

Strategy: Establish, maintain, or improve riparian habitat on streams in Topeka shiner watersheds.

Strategy: Improve grazing/agricultural crop production and construction practices in watersheds containing Topeka shiners through utilization of Topeka shiner and prairie stream BMP guidance, and agricultural/construction programs and practices designed to reduce soil loss.

Strategy: Participate in the state (EPA/DNR Section 319) nonpoint source management program as stakeholder. Grant funds are available to address nonpoint source pollution.

Objective 2: Reduce the negative impact of impoundments on watersheds containing Topeka shiners.

Strategy: Reduce the number of new ponds or modify placement and design of ponds with the cooperation of willing landowners in Topeka shiner watersheds.

Strategy: Reduce or eliminate predatory fish stocked in impoundments in watersheds containing Topeka shiners.

Strategy: Explore pond and spillway designs that would reduce or eliminate escapement of predatory fish.

Objective 3: Reduce excessive input of nutrients into streams in Topeka shiner watersheds.

Strategy: Encourage agricultural crop production and grazing practices with the least detrimental impact on streams in Topeka shiner watersheds. Provide technical guidance and cost share programs to provide an adequate buffer from agricultural crop production and/or grazing along streams containing Topeka shiners.

Strategy: Minimize water quality impacts from nutrients generated by concentrated animal feeding operations in Topeka shiner watersheds.

Strategy: Participate in the state (EPA/DNR Section 319) nonpoint source management program as stakeholder. Grant funds are available to address nonpoint source pollution.

Objective 4: Reduce point source pollution from known sources and reduce the likelihood of accidental spills.

Strategy: Minimize water quality impacts from point sources, including (but not limited to) airports, sewage treatment plants, septic systems, pipelines, highways, and petroleum storage facilities.

Objective 5: Minimize the impacts of urbanization on watersheds containing Topeka shiners.

Strategy: Work with local planning and zoning boards (or other local land development commissions) to encourage incorporation of Topeka shiner BMPs and other aquatic resource safeguards into land development in Topeka shiner watersheds (with priority on riparian areas).

Strategy: Minimize the effects of urban expansion by encouraging the use of greenways, flood retention structures, rain gardens, judicial use of fertilizers and pesticides, etc.

Objective 6: Eliminate stream channelization, work to improve previously channelized reaches, and eliminate or minimize improper sand and gravel removal within watersheds containing Topeka shiners.

Strategy: Promote the proper removal of sand and gravel by obtaining the appropriate permits and following all protective guidelines in the permit.

Strategy: Encourage use of Topeka Shiner Best Management Practices (BMP) and Missouri Prairie Stream Fish BMP documents to provide guidance on practices that are the least destructive Topeka shiner habitat.

Objective 7: Provide technical advice to landowners to help them meet their management objectives in a manner that enhances and improves stream and riparian habitat quality in Topeka shiner watersheds.

Strategy: Promote stream and riparian improvement practices to landowners within Topeka shiner watersheds through local media outlets such as newspapers, SWCD newsletters, radio programs, field days, etc.

Strategy: Identify and use current state, federal, and other funding sources to help (cost share/incentives) landowners meet their land use objectives in ways that enhance stream and riparian resources in Topeka shiner watersheds.

Strategy: Staffs of various agencies working directly with landowners in Topeka shiner watersheds should collaborate on defining specific recovery objectives, coordinate efforts to implement strategies, and evaluate methods and accomplishments on a routine basis. Forming functioning Topeka shiner watershed "technical committees" may be a reasonable mechanism to plan and coordinate targeted efforts in these geographies.

Strategy: Staffs of various agencies should explore the formation of landowner advisory groups that might provide input and insight into successful marketing and implementation strategies for stream and watershed improvement practices in Topeka shiner watersheds. Working with existing stakeholder leadership groups (SWCD Boards, County Executive Committees, County Commissions, etc.) may help fulfill this strategy.

Objective 8: Secure Topeka shiner populations in 7 localities.

Strategy: Annually monitor Topeka shiner populations in Moniteau and Sugar creeks (see Appendix V).

Strategy: Stock hatchery propagated Topeka shiners at sites identified and verified based on a prioritization of sites (i.e. Tier 1, Tier 2, Tier 3) until 7 populations are established and secure.

Strategy: Annually monitor Topeka shiner populations at localities of introduction/reintroduction (see Appendix V).

Strategy: Continue to sample sites for possible Topeka shiner populations based on field reports and modeling (see Appendix V).

Strategy: When suitable Topeka shiner sites are not available on government owned property or through other interested parties, utilize cost-share payments, easements, and/or acquisitions (from willing sellers) to secure suitable sites.

PROJECTED MDC BUDGET FOR TOPEKA SHINER RECOVERY
FY2011 – FY2015

The following budget proposal represents realistic MDC expenditures necessary to expedite the recovery of the Topeka shiner in Missouri. This budget encompasses five fiscal years starting in fiscal year 2011 and concluding in fiscal year 2015. Funds requested will provide for monitoring existing and newly introduced Topeka shiner populations, propagation of Topeka shiners for recovery, continued efforts to locate additional populations of Topeka shiners, provide funding for a small research project, continued participation on the Topeka Shiner Federal Recovery Team, continued support of the Missouri Topeka Shiner Working Group, supplemental landowner cooperative projects to enhance Topeka shiner habitat where other funding sources cannot be utilized or are not adequate to cover incurred costs. No funds are included in this budget to cover costs of land acquisition or easement, although land acquisition/easement may be required to benefit Topeka shiners and other associated headwater prairie stream fauna at certain locations. This budget by no means covers all costs associated with the Topeka shiner over the next five years, since some initiatives that may be undertaken during the next five years are not yet envisioned. This budget represents MDC expenditures and funds secured from other outside sources. A more detailed breakdown of the proposed budget can be found in Appendix VI.

I. Monitoring Existing Populations in Moniteau and Sugar Creeks
Costs include staff time, vehicle costs, and equipment/supplies **$92,465**

II. Introduction of Topeka Shiner Populations at Three Primary Recovery Sites
Costs include staff time, site preparation, public meetings, and equipment/supplies. This does not include propagation costs. **$17,700**

III. Monitoring Introduced Populations at Three Primary Recovery Sites
Costs include staff time, vehicle costs, and equipment/supplies **$31,443**

IV. Propagation of Topeka Shiners for Reintroduction
Costs include staff time, vehicle costs, feed, disease control, tank/water use **$43,195**

V. Sampling Efforts to Locate Additional Topeka Shiner Populations
Costs include staff time, vehicle costs, travel expenses, and equipment/supplies **$20,419**

VI. Landowner Cooperative Projects
Costs include staff time, vehicle costs, materials/supplies, and contracting **$47,360**

VII. Research Project (Two Year Duration)
Costs include staff time, vehicle costs, contracting with a university, equipment & supplies, and travel expenses **$75,277**

VIII. Federal Recovery Team and State Working Group Support
Costs include staff time and travel expenses **$12,500**

TOTAL FIVE YEAR BUDGET (FY11 – FY15) **$340,359**

ANNUAL AVERAGE BUDGET ($340,359 ÷ 5 years) **$68,072**

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APPENDIX I: FINANCIAL INCENTIVE PROGRAMS FOR THE PRIVATE LANDOWNER

Note- Funding, availability, and administration of programs detailed in this appendix are dynamic and dependent on many economic and socio-political variables. Undoubtedly, available programs and other funding sources listed will be discontinued and/or modified over the duration of this plan. This appendix provides a "snapshot" of programs that have and may continue to benefit Topeka shiner watersheds in Missouri and should not be considered an all-inclusive list.

Soil and Water Conservation Program (SWCP), Missouri Department of Natural Resources (MoDNR) –

A portion of the one-tenth-of-one-percent parks, soils and water sales tax of Missouri is designated to provide landowners with cost share financial assistance to implement conservation practices that reduce soil erosion and improve water quality. The funding is allocated and administered by county Soil and Water Conservation Districts. There are currently 18 cost share practices supported by SWCP.

Agricultural Non-point Source Pollution Special Area Land Treatment (AgNPS SALT), Missouri Department of Natural Resources (MoDNR)--

The AgNPS SALT Program is offered through the Missouri Department of Natural Resources' (MoDNR) Soil and Water Conservation Program (SWCP) and funded through the one-tenth-of-one-percent parks, soils and water sales tax of Missouri. The AgNPS SALT program is designed to provide county soil and water conservation districts (SWCD) with a mechanism to address agricultural nonpoint source pollution problems impacting water quality in targeted watersheds. AgNPS SALT Project watersheds average about 50,000 acres in size. Since its inception, there have been eight calls for AgNPS SALT Projects with 90 projects approved throughout the state. Sixteen projects concluded as of December 31, 2006 and ten new projects began on June 1, 2007. All three Missouri watersheds with extant or recently extirpated Topeka shiner populations have been approved for AgNPS SALT Project funding. The Sugar Creek AgNPS SALT Project in Harrison County began July 1, 1998 and concluded June 30, 2005. The SWCD reported 89% of the resource goals were achieved at a cost of approximately $1.5 million. The Bonne Femme Creek AgNPS SALT Project, Boone County, began December 14, 1997 and concluded June 30, 2002. The Boone County SWCD reported that the project goals were completed at a cost of nearly $0.5 million. The Moniteau Creek basin is targeted with two separate AgNPS SALT projects. These are the Upper Moniteau Creek AgNPS SALT which is administered by Cooper County SWCD, and the Lower Moniteau Creek AgNPS SALT which is administered by the Moniteau County SWCD. Both projects began on July 1, 2004 and will conclude June 30, 2011. A total of $1.5 million ($0.75 million each) targets 77,347 acres and 71,398 acres in Cooper and Moniteau counties, respectively.

Nonpoint Source Pollution Program (EPA/DNR Section 319 Grants), Environmental Protection Agency and Missouri Department of Natural Resources –

The Nonpoint Source Pollution Program Section 319 is and EPA program administered by Missouri Department of Natural Resources. Sub grants are available to local governments, educational institutions, and 501c3 nonprofit organizations to address nonpoint source water quality issues. Funds are awarded as minigrants, up to

$10,000, watershed planning grants up to $15,000, and major sub grants up to $1,000,000. Educational and implementation projects can be provided for eligible water quality projects. More information can be found at: http://www.dnr.mo.gov/env/wpp/nps/html

Conservation Reserve Program (CRP), USDA/FSA -

CRP is a voluntary program that encourages farmers and ranchers to convert highly erodible cropland or other environmentally sensitive acreage to permanent vegetative cover, such as cool season or native grasses, wildlife plantings, trees, filter strips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices and mid-contract management cost share is available, depending on the sign-up year, to enhance CRP grass stands for wildlife. CRP contracts are 10 to 15 years in length.

Continuous Conservation Reserve Program (CCRP), USDA/FSA –

CCRP is a voluntary program designed to encourage landowners to plant permanent vegetation on or along environmentally sensitive areas to protect water Quality, reduce soil erosion, and enhance habitat for wildlife. As its name implies, sign-up for CCRP is "continuous" meaning that producers can sign-up for these conservation practices at anytime as long as funding allows. Key practices in CCRP are conservation buffers and small wetland development practices. CCRP contracts are 10 to 15 years in duration.

Conservation Stewardship Program (CSP, formerly the "Conservation Security Program), USDA/NRCS –

The 2008 Farm Bill replaces the Conservation Security Program with the Conservation Stewardship Program for the federal fiscal years 2009 through 2017. CSP is designed to encourage producers to address resource concerns in a comprehensive way including implementing additional conservation activities and improving, maintaining, and managing existing conservation activities. Contracts will cover the entire farm and are five years in length. Payments compensate producers for additional conservation practices, improving, maintaining, and managing approved conservation activities, adopting resource conserving crop rotations, and engaging in on-the farm conservation research and technology activities.

Environmental Quality Incentives Program (EQIP), USDA/NRCS -

EQIP is designed to provide a voluntary conservation program for farmers and ranchers who face serious threats to soil, water, and related natural resources. This program offers financial, educational, and technical help to install or implement structural, vegetative, and management practices. Funding is allocated by county on an annual basis.

Wildlife Habitat Incentive Program (WHIP), USDA/NRCS -

WHIP provides financial incentives to develop habitat for fish and wildlife on private lands. Participants agree to implement a wildlife habitat development plan and USDA agrees to provide cost-share assistance for the initial implementation of wildlife habitat development practices. USDA and program participants enter into a cost-share agreement. USDA provides technical assistance and pays up to 50 to 75% of the cost of installing the wildlife habitat practices.

Partners for Fish and Wildlife (PFFW), U.S. Fish and Wildlife Service -

Partners for Fish and Wildlife program is a cooperative effort with private landowners who have voluntarily offered to restore drained, degraded and marginal habitats. Through this program the Service has: 1) Restored important wetlands, associated uplands, in-stream habitats, and riparian corridors for the benefit of migratory birds, endangered species and native fish on private, non-Federal and tribal lands, and 2) Encouraged cooperation with thousands of partners to cost-share expenses of most restoration projects. In addition to enhancing fish and wildlife habitats, soil and water conservation values associated with the PFFW program include reduced runoff, reduced soil erosion, conservation education and outreach potential, enhanced recreational opportunities, and improved economic opportunities. Partners include state fish and wildlife agencies, soil and water conservation districts, individuals, communities and private conservation organizations.

Stream Stewardship Trust Fund (SSTF), Missouri Conservation Heritage Foundation (MCHF) –

The SSTF is established through a Memorandum of Understanding (MOU) between the MCHF and the US Army Corps of Engineers (USCOE) and is designed to provide a stream mitigation option that benefits aquatic resources, regulators, and Section 404 applicants. Trust fund dollars are earmarked for the restoration, enhancement, and/or protection of streams and associated riparian habitats. The SSTF can support restoration costs of projects and the sites must be covered by a 30 year agreement, permanent easement, or land acquisition. The SSTF has successfully been employed in the Sugar Creek watershed to secure conservation easements protecting riparian habitat benefiting Topeka shiners.

Landowner Assistance Program (LAP), Missouri Department of Conservation (MDC) –

The LAP is designed to assist landowners with meeting their habitat management objectives. Its primary purpose is to fill in gaps where other state and federal programs are not available or the landowner is not eligible for these opportunities. LAP offers 50% up to 75% cost share for the installation of practices that benefit forest, fish, and wildlife resources. There are currently 18 practices on the LAP docket and some of these benefit stream and riparian habitats.

APPENDIX II: LAND USE INFORMATION FOR BONNE FEMME, MONITEAU, AND SUGAR CREEK WATERSHEDS

Table 1. Landuse/landcover statistics for Bonne Femme, Moniteau, and Sugar creek watersheds (MoRAP 2005).

	Area (%)		
Landcover Type	Bonne Femme	Moniteau	Sugar
Urban/Impervious	4%	1%	3%
Cropland	23%	21%	48%
Grassland	35%	47%	31%
Forest	36%	28%	16%
Wetland	1%	2%	1%
Open Water	1%	1%	1%
Total	100%	100%	100%

	Area ($miles^2$)		
Landcover Type	Bonne Femme	Moniteau	Sugar
Urban/Impervious	1.9	3.4	3.4
Cropland	11.8	47.6	52.1
Grassland	18.5	107.4	33.8
Forest	19.0	64.4	17.0
Wetland	0.7	4.6	1.6
Open Water	0.7	1.8	0.8
Total	52.6	229.1	108.7

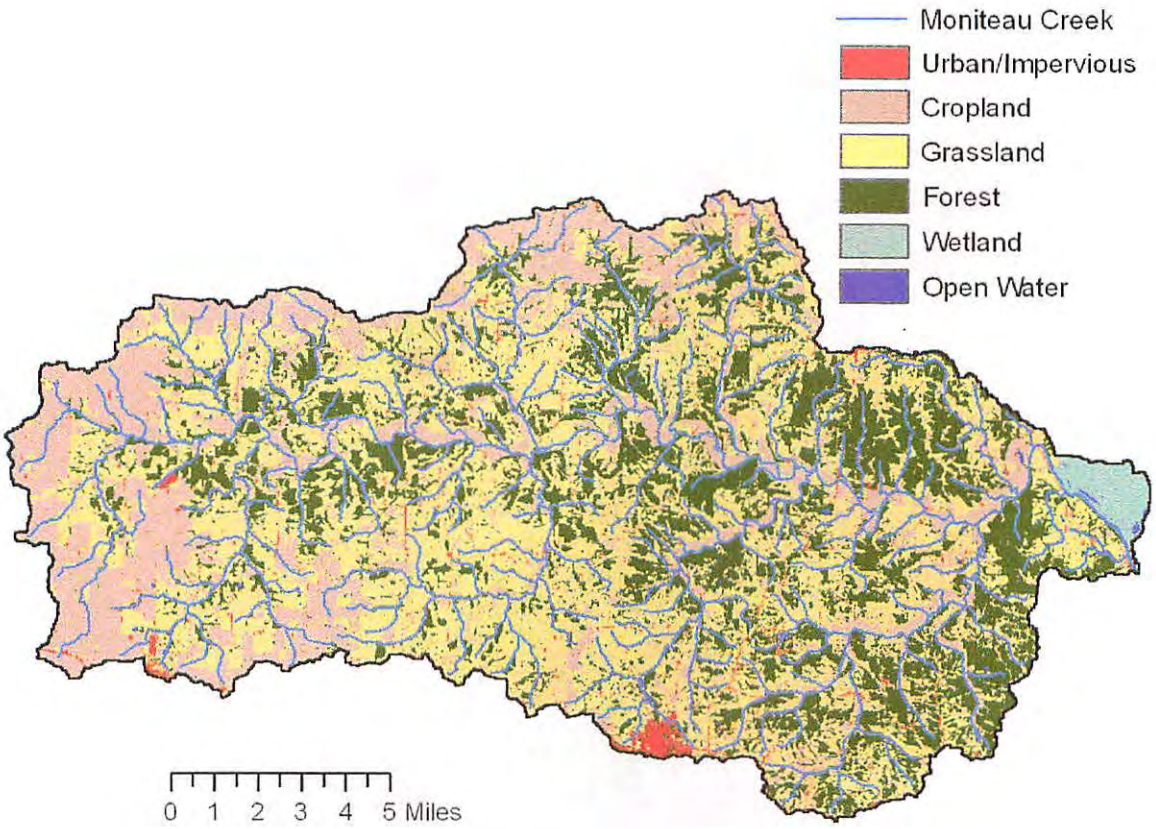

Figure 10. Landcover characteristics of the Moniteau Creek watershed.

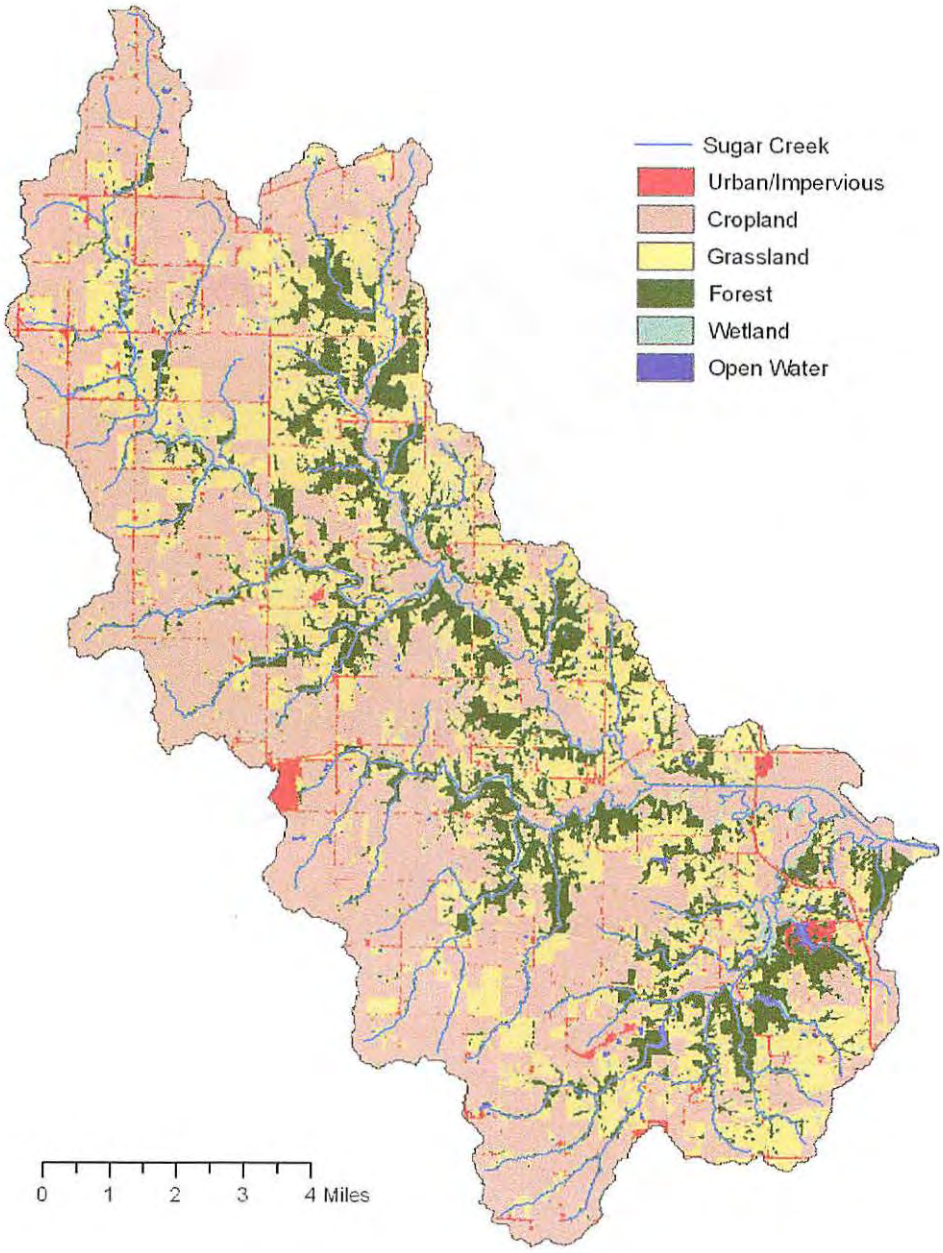

Figure 11. Landcover characteristics of the Sugar Creek watershed.

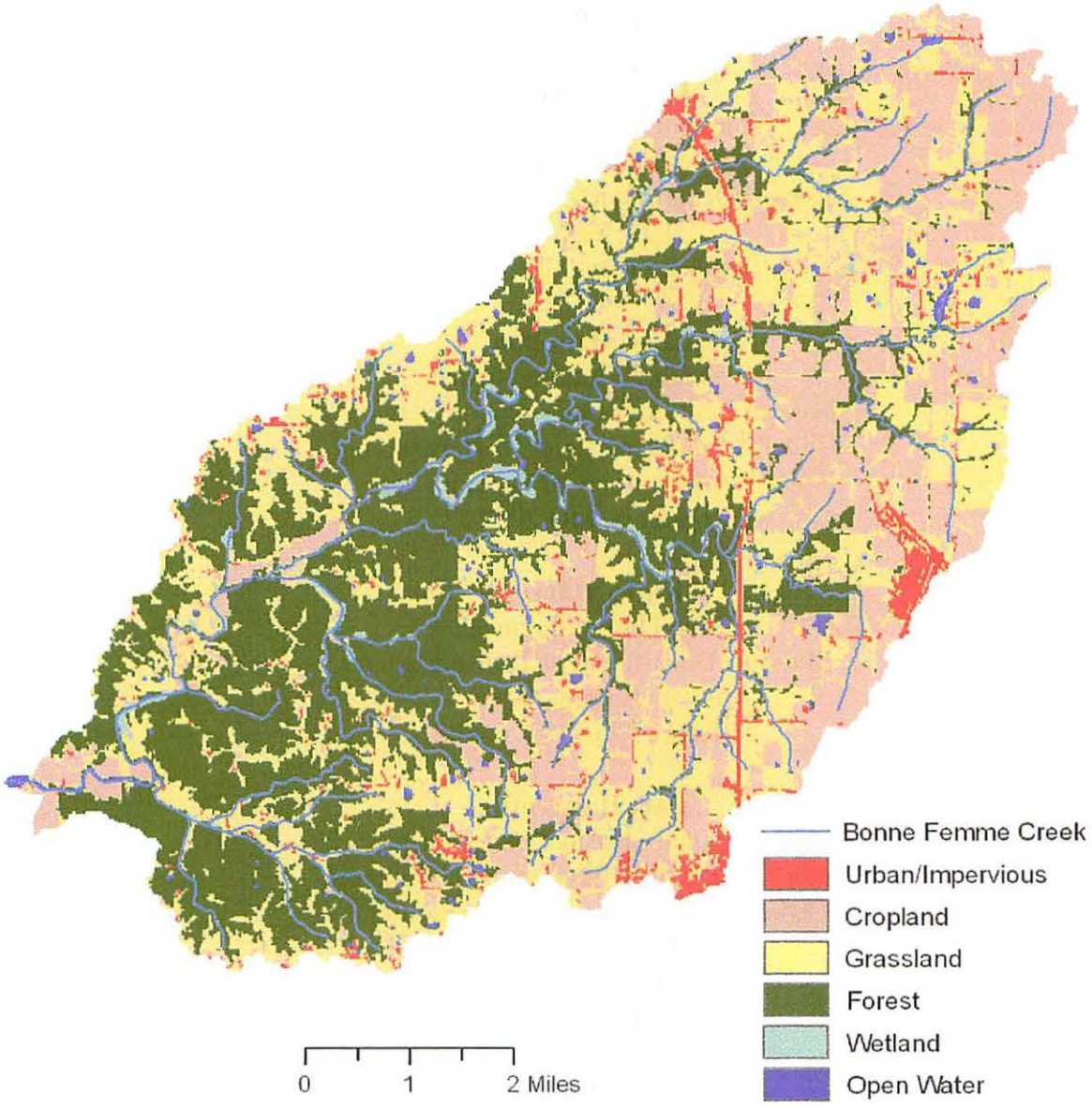

Figure 12. Landcover characteristics of the Bonne Femme watershed.

APPENDIX III: TOPEKA SHINER INTERAGENCY STATE WORKING GROUP MEMBERS

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APPENDIX V
TOPEKA SHINER POPULATION MONITORING IN MISSOURI

Population monitoring is an integral part of species recovery efforts. Monitoring is necessary to evaluate the success of recovery efforts and to reevaluate population status. A monitoring plan must provide precise, measurable, statistically defendable criteria used to objectively evaluate population status. Monitoring programs must be sensitive enough to detect substantial population changes and extensive enough to accurately represent populations being monitored. For Topeka shiners in Missouri, the monitoring program is focused on the two watersheds currently supporting significant populations (Moniteau Creek and Sugar Creek) and should be able to detect population changes in each of these populations independently. Criteria and methods used to develop a monitoring program for Topeka shiners in Missouri are listed below.

Additionally a monitoring program must also be developed to evaluate the status of all Topeka shiner populations introduced/established as part of the recovery of this species. It is anticipated the monitoring of these populations will utilize a similar methodology as described below and already established in monitoring Topeka shiners in Missouri over the past 9 years.

Level of Trend to Detect
A monitoring program should at least be able to detect a 5% increase or decline per year (5 year – 23%, 10 year – 40%, 15 year – 54%, 20 year – 64%). This is similar to trend levels used in monitoring programs for other species of conservation concern. Because reproductive success varies widely from year to year, the abundance of adult Topeka shiners provides the best estimate of population status and should be the basis for establishing temporal trends. The abundance of juveniles provides important information on population structure and recruitment.

Alpha
The Alpha level (α) indicates the percentage of time that you are likely to "cry wolf" (i.e. claim that a trend exists when it really does not). To decrease alpha, however, sample size must increase so a reasonable tradeoff must be determined. In monitoring programs, "crying wolf" is much more acceptable than allowing a decline to go unnoticed because of an overly stringent requirement of statistical significance. Therefore, an alpha of 0.1 (instead of the traditional 0.05) is a good tradeoff for monitoring programs.

Power
The power of a test lies in its ability to detect trends that really do exist. This is the key element of any monitoring program. If power is low, for example, you are unlikely to detect an existing trend. Because the purpose of monitoring programs is to detect trends in time to react, the power of the test needs to be high. Therefore, a Power of 0.9 is desirable. This means that a significant trend (as defined in the monitoring plan) will be detected 90% of the time.

Natural Variation
An idea of the variation in population numbers (due to natural variation and sampling error) is necessary to determine the sampling efforts required to detect trends in spite of this variation. Data from Moniteau Creek suggests that a coefficient of variation of 0.6 for the total number of adult Topeka shiners (sites combined) or 1.3 when averaged across sites would be reasonable.

Sample Size
Power analyses were conducted with software developed by Gibbs (1995) and Gibbs and de Arellano

(2006) and assuming an analysis method such as route regression. With the criteria listed above, a monitoring program would require 77 sites sampled once a year to detect a 5-year trend, 18 sites to detect a 10-year trend, **12 sites to detect a 15-year trend,** 9 sites to detect a 20-year trend, and 9 sites to detect a 30-year trend.

Duration of Monitoring Program

Monitoring programs must be conducted for at least 10 years to detect trends with reasonable effort. Studies of shorter duration, unless extremely intensive, have very little chance of detecting even large population changes. Also, long-term monitoring is necessary to evaluate results of recovery efforts which may require many years to become apparent. The sample size/statistical power relationship described above (*Sample size*) as well as the expected time frame for recovery efforts to be realized indicates that a monitoring program of at least 15 years would be desirable. The most recent data (2008) available from the Moniteau Creek population indicates with 10 sites contributing useful data, a 15-year monitoring program will detect a 6% decline in the log-transformed densities (#/100 m) of adult Topeka shiners with alpha = 0.1 and power = 0.9. The current monitoring program should also be sufficient to detect a 10% decline in 10 years.

Current Population Status

Because information was lacking on Topeka shiner distribution and abundance in these watersheds, a necessary first step was obtaining this information. Stream fish communities in these two watersheds were sampled extensively in September 1998 to determine Topeka shiner distributions. Distribution maps were developed for each watershed. During this and subsequent sampling, it was determined Topeka shiners no longer exist in the Bonne Femme Creek watershed in Boone County.

Selection of Monitoring Sites

At least 12 sites per watershed (*see Sample Size*) were **systematically** located within streams known to support Topeka shiners (determined from September 1998 sampling). Locating sites within known current ranges of Topeka shiners was preferable because if sites were located randomly most sites would be in areas lacking Topeka shiners. This is a valid approach because we are most interested in how current populations of Topeka shiners in these watersheds are doing. Additional sites which do not currently support Topeka shiners but which have relatively high-quality habitat and diverse fish communities can be included as additional sites to monitor. Coordinates of each site were recorded and used to develop GIS maps of monitoring locations. Each site is 200 m (656 ft) in length and contains a good representation of the habitat in that stream segment. Upstream and downstream ends of each sampling site were permanently marked to ensure the same site is sampled each year.

Sampling

Each site is sampled once per year in late September to early October during base flow conditions. All non-riffle habitats within the sampling site are seined once with a 1.8, 4.6, or 6.1-m (6, 15, or 20-ft.) drag seine with ⅛ or ¼-inch mesh. All fish are identified to species, counted and/or categorized into relative abundance categories, and released on-site. Topeka shiners, trout-perch (state species of conservation concern) and all sunfish species (i.e. bluegill, green sunfish, largemouth bass, orangespotted sunfish, etc.) are counted, and then released on-site. On Moniteau Creek Topeka shiners are digitally photographed in a water-filled tray with a measurement scale for later determinations of total length.

APPENDIX VI

ESTIMATED 5 YEAR BUDGET FOR TOPEKA SHINER RECOVERY IN MISSOURI

MONITORING EXISTING POPULATIONS

MONITEAU CREEK

	FY11	FY12	FY13	FY14	FY15	Total
Staff Expense						
Permanent	8300	8470	8635	8800	8970	43,175
Temporary Labor	1720	1755	1790	1820	1860	8,945
Vehicle Expense (Fuel costs only)	100	100	100	100	105	505
Supplies & other expenses	635	650	660	670	685	33,000
TOTAL	**10,755**	**10,975**	**11,185**	**11,390**	**11,620**	**55,925**

SUGAR CREEK

	FY11	F12	FY13	FY14	FY15	Total
Staff Expense						
Permanent	6425	6555	6685	6810	6940	33,415
Vehicle Expense	350	360	365	370	380	1,825
Supplies & other expenses	250	255	260	265	270	1,300
TOTAL	**7,029**	**7,170**	**7,310**	**7,445**	**7,590**	**36,540**
COMBINED TOTAL	**17,784**	**18,145**	**18,495**	**18,835**	**19,210**	**92,465**

INTRODUCTIONS TO THREE PRIMARY RECOVERY SITES (EXCLUDING HATCHERY PRODUCTION EXPENSE)

Little Creek (Harrison County)

	FY11	Total
Public Meeting (travel, staff time, room rental	800	800
Spawning gravel in ponds	2,000	2,000
Predator fish removal/rotenone/ treatment	2,250	2,250
Aquatic Herbicide/treatment	1,250	1,250
TOTAL	**6,300**	**6,300**

Big Muddy Creek (Harrison County)

	FY11	Total
Public Meeting (travel, staff time, room rental	800	800
Spawning gravel in ponds	2,000	2,000
Predator fish removal/rotenone/treatment	2,250	2,250
Aquatic Herbicide/treatment	1,250	1,250
TOTAL	**6,300**	**6,300**

Spring Creek (Adair, Putnam & Sullivan counties)

	FY11	Total
Public Meeting (travel, staff time, room rental	600	600
Spawning gravel in ponds	2,000	2,000
Predator fish removal/rotenone/treatment	2,000	2,000
Aquatic Herbicide/treatment	500	500
TOTAL	**5,100**	**5,100**
COMBINED TOTAL	**17,700**	**17,700**

MONITORING INTRODUCED POPULATIONS

Little Creek (Harrison County)

	FY11*	FY12	FY13	FY14	FY15	Total
Staff Expense						
Permanent (3 man days)	1380	1415	1450	1485	1520	7,250
Temporary Labor (3 man days)	190	195	200	205	210	1,000
Vehicle Expense (Fuel costs only)	300	308	315	323	330	1,576
Supplies & other expenses	125	128	131	134	137	655
TOTAL	**1,995**	**2,046**	**2,096**	**2,147**	**2,197**	**10,481**

Big Muddy Creek (Harrison County)

	FY11*	FY12	FY13	FY14	FY15	Total
Staff Expense						
Permanent (3 man days)	1380	1415	1450	1485	1520	7,250
Temporary Labor (3 man days)	190	195	200	205	210	1,000
Vehicle Expense (Fuel costs only)	300	308	315	323	330	1,576
Supplies & other expenses	125	128	131	134	137	655
TOTAL	**1,995**	**2,046**	**2,096**	**2,147**	**2,197**	**10,481**

Spring Creek (Adair, Putnam & Sullivan counties)

	FY11*	FY12	FY13	FY14	FY15	Total
Staff Expense						
Permanent (3 man days)	1380	1415	1450	1485	1520	7,250
Temporary Labor (3 man days)	190	195	200	205	210	1,000
Vehicle Expense (Fuel costs only)	300	308	315	323	330	1,576
Supplies & other expenses	125	128	131	134	137	655
TOTAL	**1,995**	**2,046**	**2,096**	**2,147**	**2,197**	**10,481**
Combined Totals	**5,985**	**6,138**	**6,288**	**6,441**	**6,591**	**31,443**

*** Sampling downstream areas prior to Topeka shiner introduction**

PROPAGATION OF TOPEKA SHINER COSTS

	FY11	FY12	FY13	FY14	FY15	Total
Staff Expense						
Permanent (12 man day 2755)	5510	3770	3860	3950	4040	21,130
Temporary (8 man days 1837)	800	530	540	550	570	2,990
Vehicle Expense (delivery costs)	650	670	690	710	730	3,450
Inside tank/water use	1550	1550	1550	1550	1550	7,750
Feed/Disease/other expenses	1500	1540	1570	1615	1650	7,875
TOTAL	**10,010**	**8,060**	**8,210**	**8,375**	**8,540**	**43,195**

SAMPLING EFFORTS TO LOCATE ADDITIONAL TOPEKA SHINER POPULATIONS

5 - Year Costs for Searching for New Topeka Shiner Populations

	Cost per Year	5-Year TOTAL	Description
Expenses	$100.00	$500.00	Seines, waders, boots, misc supplies, water chemistry supplies
Equipment	-	-	
Vehicle Costs	$120.00	$600.00	Fuel
Travel Expenses	$220.00	$1,100.00	Lodging and food for 2 nights , 3 employees
Temp Labor	$680.00	$3,400.00	2 hourlies x 5 days
Salaried Labor (+ benefits)	$2,110.00	$10,550.00	1 Resource Scientist/Fisheries Biologist and 1 Resource Science Assistant x 15 days
Sub-Total	$3,230.00	$16,150.00	
Indirect Costs (26.43%)	$853.69	$4,268.45	
TOTAL	**$4,083.69**	**$20,418.45**	

LANDOWNER COOPERATIVE PROJECTS

	5 - YEAR TOTAL
Riparian buffer restorations (outside of USDA programs)	
fencing, alternative livestock water, bank stabilization	
Predator removal /10-year fishless pond leases ($500/pond)	$6,000
Predator removal/10-year Topeka shiner ponds ($1000 pond)	$11,000
40 man-days MDC biologists @ $259/day	$10,360
TOTAL	**$47,360**

RESEARCH PROJECT

"Spawning Behavior and Interspecific Interactions of the Topeka Shiner in Missouri"

Project Description: Fixed cost contract for total amount to funds MS student project, mostly lab study using University Facilities.

Project Goal: Determine the spawning requirements and typical behaviors of Topeka shiner in Moniteau Creek, including habitat needs and importance of spawning associates such as green, orangespotted, and longear sunfish.

	Year 1	Year 2	Total	Description
Expense	$25,000.00	$25,000.00	$50,000.00	Contract for MS Graduate Student stipend, project supplies for field and lab experiments and publication costs.
Equipment	$5,000.00	$1,000.00	$6,000.00	aquaria, etc.
Vehicle Costs	$200.00	$200.00	$400.00	fuel
Travel Expenses	-	$600.00	$600.00	Attend 1 conference to present study results
Temp Labor	-	-	-	Assistance provided via MDC intern or similar
Salaried Labor (+ benefits)	$1,270.00	$1,270.00	$2,540.00	Resource Scientists time to sit on graduate student's Committee, organize funding, etc. (5 days)
Sub-Total	**$31,470.00**	**$28,070.00**	**$59,540.00**	
Indirect Costs (26.43%)	$8,317.52	$7,418.90	$15,736.42	
TOTAL	**$39,787.52**	**$35,488.90**	**$75,276.42**	

August 2010

August 2010

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September 2010

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Aug 1 - 7	**Aug 1** Shoemaker Reunion (L	**2** Anderson (Branson) - M Ryan Yarbrough BD	**3** Anderson (Branson) - M 10:30am I-9's (Conf Rm Administrative Services) - Kari Hayes 6:00pm B-Group	**4** Anderson (Branson) - M	**5** Anderson (Branson) - M 10:00am 2 year report (Vitello's Office) - Megan Halford 2:30pm Marty's Birthday (PCU Conference R	**6** Anderson (Branson) - M	**7** Bill Anderson (SOH) - M
Aug 8 - 14	**8** Bill Anderson (SOH) - M Choo Halford BD	**9** Bill Anderson (SOH) - M 3:00pm DCM (Commission Mtg Rm) - Megan Halford	**10** Bill Anderson (SOH) - M 8:00am Regulations Committee Meeting (Auditorium) - Denise Ba 3:30pm Midwest Fish and Wildlife Conference	**11** Bill Anderson (SOH) - M	**12** Bill Anderson (SOH) - M	**13** State Fair	**14**
Aug 15 - 21	**15**	**16** 1:30pm FY12 Executive Budget (Conf Rm HR) - Chris Vitello	**17**	**18** 9:00am New Employee Checklist Review - Draft (Conf Rm PLS) - JoAnn Hanley	**19** Commission Mtg (Jefferson City) - Megan Halford	**20**	**21**
Aug 22 - 28	**22** Bill Anderson (Andersor	**23** Bill Anderson (Andersor Kim Bax 3:00pm DCM (Commission Mtg Rm) - Megan Halford	**24** Bill Anderson (Andersor 9:00am DMT (HR Conf Rm.) - Megan Halford	**25** Bill Anderson (Andersor	**26** Bill Anderson (Andersor Paul Calvert's BD 9:00am OM Conf Call	**27**	**28**
Aug 29 - Sep 4	**29**	**30** 9:00am Expanded Staff Mtg - Megan Halford	**31**	**Sep 1**	**2**	**3**	**4**